SSOAR

Open Access Repository
www.ssoar.info

The Crisis of the 14th Century: Teleconnections between Environmental and Societal Change?

Bauch, Martin (Ed.); Schenk, Gerrit Jasper (Ed.)

Veröffentlichungsversion / Published Version
Sammelwerk / collection

Die Publikation wurde durch den Open-Access-Publikationsfonds für Monografien der Leibniz-Gemeinschaft gefördert. / The publication was supported by the Open Access Publishing Fund of the Leibniz Association.

Empfohlene Zitierung / Suggested Citation:
Bauch, M., & Schenk, G. J. (Eds.). (2019). *The Crisis of the 14th Century: Teleconnections between Environmental and Societal Change?* (Das Mittelalter: Perspektiven mediävistischer Forschung; Beihefte, 13). Berlin: De Gruyter. https://doi.org/10.1515/9783110660784

Nutzungsbedingungen:
Dieser Text wird unter einer CC BY-NC-ND Lizenz (Namensnennung-Nicht-kommerziell-Keine Bearbeitung) zur Verfügung gestellt. Nähere Auskünfte zu den CC-Lizenzen finden Sie hier:
https://creativecommons.org/licenses/by-nc-nd/4.0/deed.de

Terms of use:
This document is made available under a CC BY-NC-ND Licence (Attribution-Non Comercial-NoDerivatives). For more Information see:
https://creativecommons.org/licenses/by-nc-nd/4.0

gesis Leibniz-Institut für Sozialwissenschaften

Mitglied der Leibniz-Gemeinschaft

Diese Version ist zitierbar unter / This version is citable under:
https://nbn-resolving.org/urn:nbn:de:0168-ssoar-66619-8

The Crisis of the 14th Century

Das Mittelalter
Perspektiven mediävistischer Forschung

Beihefte

Herausgegeben von
Ingrid Baumgärtner, Stephan Conermann
und Thomas Honegger

Band 13

The Crisis of the 14th Century

Teleconnections between Environmental and Societal Change?

Edited by
Martin Bauch and Gerrit Jasper Schenk

DE GRUYTER

Gefördert von der VolkswagenStiftung aus den Mitteln der Freigeist Fellowship „The Dantean Anomaly (1309–1321)“ / *Printing costs of this volume were covered from the Freigeist Fellowship „The Dantean Anomaly 1309-1321“, funded by the Volkswagen Foundation.*

Die frei zugängliche digitale Publikation wurde vom Open-Access-Publikationsfonds für Monografien der Leibniz-Gemeinschaft gefördert. / *Free access to the digital publication of this volume was made possible by the Open Access Publishing Fund for monographs of the Leibniz Association.*

Der Peer Review wird in Zusammenarbeit mit themenspezifisch ausgewählten externen Gutachterinnen und Gutachtern sowie den Beiratsmitgliedern des Mediävistenverbands e. V. im Double-Blind-Verfahren durchgeführt. / *The peer review is carried out in collaboration with external reviewers who have been chosen on the basis of their specialization as well as members of the advisory board of the Mediävistenverband e.V. in a double-blind review process.*

ISBN 978-3-11-065763-0
e-ISBN (PDF) 978-3-11-066078-4
e-ISBN (EPUB) 978-3-11-065796-8

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. For details go to http://creativecommons.org/licenses/by-nc-nd/4.0/.

Library of Congress Control Number: 2019947596

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available on the Internet at http://dnb.dnb.de.

© 2020 Martin Bauch, Gerrit Jasper Schenk, published by Walter de Gruyter GmbH, Berlin/Boston.
The book is published with open access at degruyter.com.

Typesetting: Integra Software Services Pvt. Ltd.
Printing and binding: CPI books GmbH, Leck

www.degruyter.com

Contents

Martin Bauch, Gerrit Jasper Schenk
Teleconnections, Correlations, Causalities between Nature and Society? An Introductory Comment on the "Crisis of the Fourteenth Century" —— 1

Peter Brown
***Ventus vehemens et terribilis per totam Angliam*: Responses and Reactions to a Short-term Crisis in the British Isles —— 24**

Chantal Camenisch
The Potential of Late Medieval and Early Modern Narrative Sources from the Area of Modern Switzerland for the Climate History of the Fourteenth Century —— 43

Marko Halonen
***Hic aues incipiunt cantare*: Shifts in the Beginning of Seasons in Medieval Calendars of Rome and the Nordic Countries —— 62**

Heli Huhtamaa
Climate and the Crises of the Early Fourteenth Century in Northeastern Europe —— 80

Andrea Kiss, Ferenc Piti, Ferenc Sebők, Éva Teiszler
Food Crisis in Fourteenth-Century Hungary: Indicators, Causes and Case Studies —— 100

Thomas Labbé
The Crisis of 1315–1322 in Bresse as Depicted in Manorial Rolls —— 130

Tana Li
The Mongol Yuan Dynasty and the Climate, 1260–1360 —— 153

Paolo Nanni
Facing the Crisis in Medieval Florence: Climate Variability, *Carestie*, and Forms of Adaptation in the First Half of the Fourteenth Century —— 169

Johannes Preiser-Kapeller, Ekaterini Mitsiou
The Little Ice Age and Byzantium within the Eastern Mediterranean, ca. 1200–1350: An Essay on Old Debates and New Scenarios —— 190

Rainer Schreg
Plague and Desertion – A Consequence of Anthropogenic Landscape Change? Archaeological Studies in Southern Germany —— 221

Maximilian Schuh
Narratives of Environmental Events in the Winchester Pipe Rolls and English Historiography of the Early Fourteenth Century —— 247

András Vadas
The Little Ice Age and the Hungarian Kingdom? Sources and Research Perspectives —— 263

Richard C. Hoffmann
Thoughts on a Connected Fourteenth Century —— 280

Index of Places —— 289

Index of Names —— 297

Martin Bauch, Gerrit Jasper Schenk

Teleconnections, Correlations, Causalities between Nature and Society? An Introductory Comment on the "Crisis of the Fourteenth Century"

Abstract: The introductory comment revisits older discussions in medieval studies about the "Crisis of the Fourteenth Century," connecting it – as recent studies suggest – to a general increase in the intensity and frequency of natural extreme events between the turn of the century and the ravages of the Black Death in mid-century. New approaches to this period of transition examine how societal phenomena coincided with rapid or gradual environmental changes and attempt to establish the relationship between causality and correlation; these methods challenge – albeit without reverting to climatic or environmental determinism – established historiographical paradigms that have tended to explain social facts via other social facts (Durkheim). Hence, the introduction discusses new theoretical tools in environmental history like consilience, resilience, vulnerability, and man-nature-interaction models, such as, for example, those developed by the Vienna School (Winiwarter), but also approaches which have received less attention, like Luhmann's ecological communication, the Panarchy model (Gunderson/Holling), and Lovelock's Gaia hypothesis. In the interest of promoting a pragmatic heuristic perspective, the editors expand on the idea of societal teleconnections of meteorological extreme events (Moser/Finzi Hart), as this concept integrates delayed effects and feedback loops, acknowledges spatial crosslinks, and avoids hierarchical impact-levels. Applying the meteorological term "teleconnection" in social historical studies allows for the discovery of "strange parallels" (Lieberman) in the socio-economic development of otherwise unconnected areas of the world, and these synchronicities, in turn, open avenues for the further development of a global pre-modern environmental history.

Keywords: crisis, societal teleconnection, correlation, coincidence, causality, consilience, climate determinism, resilience, vulnerability, Gaia hypothesis, socio-natural site, great transition

Dr. Martin Bauch, Abteilung Mensch & Umwelt, Leibniz-Institut für die Geschichte u. Kultur des östlichen Europa (GWZO), Reichsstraße 4-6, D-04109 Leipzig, martin.bauch@uni-leipzig.de

Prof. Dr. Gerrit Jasper Schenk, Mittelalterliche Geschichte, Institut für Geschichte, Technische Universität Darmstadt, Dolivostraße 15, 64293 Darmstadt, schenk@pg.tu-darmstadt.de

Open Access. © 2020 Martin Bauch, Gerrit Jasper Schenk, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-001

During the fourteenth century, many Europeans felt they were living in an era of crisis *avant la lettre*[1] in which frightening events seemed increasingly frequent. For instance, the Franciscan Alvarius Pelagius, who studied the Black Death and may have been influenced by medical theories, declared his age to be a time of serious trouble, a *tempus fermentatum*, or "time of fermentation."[2] There has been extensive historical research on the crises, wars, and disasters that fourteenth century people faced.[3] In the following we name only a few well known events: the famine in northern and central Europe from 1315 to 1321; the first phase of the Hundred Years' War between France and England (1337–1386); the so-called Babylonian Captivity of the Papacy in Avignon (1309–1377) and the Western Schism (1378–1417); the waves of plague after 1347, including the agrarian crisis, the economic and demographic depression, flagellant campaigns, increasing murders of Jews, peasant revolts, upheavals in the cities and locust plagues.[4] Many contemporaries were also frightened by short-term or geographically limited events such as a recurrent cattle plague in England between 1318 and 1350, the disastrous flooding of Florence in 1333, St. Mary Magdalene's flood that affected half

1 For the concept of crisis, see Carla Meyer/ Katja Patzel-Mattern/ Gerrit Jasper Schenk, Krisengeschichte(n). "Krise" als Leitbegriff und Erzählmuster in kulturwissenschaftlicher Perspektive – eine Einführung, in: Carla Meyer/ Katja Patzel-Mattern/ Gerrit Jasper Schenk (eds.), Krisengeschichte(n). "Krise" als Leitbegriff und Erzählmuster in kulturwissenschaftlicher Perspektive (Beihefte der Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte 210), Stuttgart 2013, pp. 9–23; Stephan Haberscheid/ Lars Koch, Einleitung: Katastrophen, Krisen, Störungen, in: LiLi. Zeitschrift für Literaturwissenschaft und Linguistik 173 (2014) [http://www.lili.uni-siegen.de/ausgaben/2014/lili173.html?lang=de#einleitung (30.12.2017)]; from the perspective of system theory see Rudolf Schlögl, "Krise" als Form der gesellschaftlichen Selbstbeobachtung. Eine Einleitung, in: Rudolf Schlögl/ Philipp R. Hoffmann-Rehnitz/ Eva Wiebel (eds.), Die Krise in der Frühen Neuzeit (Historische Semantik 26), Göttingen 2016, pp. 9–31.

2 Alvarus Pelagius, De planctu Ecclesiae Alvari Pelagii Hispani ex ordine Minorum Libri duo, Venedig 1560, fol. 93rb, see Sabine Krüger, Krise der Zeit als Ursache der Pest. Der Traktat ‚De mortalitate in Alamannia' des Konrad von Megenberg, in: id. (ed.), Festschrift für Hermann Heimpel zum 70. Geburtstag am 19. September 1971 (Veröffentlichungen des Max-Planck-Instituts für Geschichte 36, 2), Göttingen 1972, pp. 839–883, here p. 844, 858.

3 See Ferdinand Seibt/ Winfried Eberhard (eds.), Europa 1400. Die Krise des Spätmittelalters. Stuttgart 1984; František Graus, Pest – Geißler – Judenmorde. Das 14. Jahrhundert als Krisenzeit (Veröffentlichungen des Max-Planck-Instituts für Geschichte 86), Göttingen ^{2}1988; Walter Buckl (ed.), Das 14. Jahrhundert: Krisenzeit (Eichstätter Kolloquium 1), Regensburg 1995; Ernst Schubert, Einführung in die deutsche Geschichte im Spätmittelalter, Darmstadt ^{2}1998, pp. 1–21; Werner Rösener, Das Wärmeoptimum des Hochmittelalters. Beobachtungen zur Klima- und Agrarentwicklung des Hoch- und Spätmittelalters, in: Zeitschrift für Agrargeschichte und Agrarsoziologie 58/1 (2010), pp. 13–30, 189–196; Harry Kitsikopoulos (ed.), Agrarian Change and Crisis in Europe, 1200–1500 (Routledge Research in Medieval Studies 1), New York, London 2012; John Drendel (ed.), Crisis in the Later Middle Ages. Beyond the Postan-Duby Paradigm (The medieval countryside 13), Turnhout 2015.

4 See Gerrit Jasper Schenk, Die Zeit Karls IV. zwischen Frost und Blüte. Katastrophen, Krisen und Klimawandel im 14. Jahrhundert, in: Kaiser Karl IV. 1316–2016. Erste Bayerisch-Tschechische Landesausstellung. Ausstellungskatalog, ed. Jiří Fajt/ Markus Hörsch, Prague 2016, pp. 30–39.

of central Europe in 1342, the earthquake in Basel in 1356, and St. Marcellus' flood in 1362 along the coast of the North Sea.[5] The list could go on and on.

Historians must ask, however, whether the frequency and intensity of these events was in fact atypical? Or does modern research rather pay too much attention to the interpretations of contemporary witnesses, perhaps even constructing a crisis where there was none at all? The central question of this volume is whether a correlation between these events can be established. Or more precisely: is there a correlation between these sociocultural phenomena and scientific evidence? We must phrase this question carefully, because there are at least three constraints regarding the assumption of such correlations: First of all, humanists and social scientists are generally reticent to explain "social facts" by means of facts taken from the physical world like environmental conditions and climatic change, genetics, lack of resources, etc. Most historians ascribe such crises to the sphere of social facts and prefer, at least since Émile Durkheim, to explain them with *faits sociaux antécédents*.[6] It is most probably due to this tradition that there are strong reservations with regard to the so-called "climate determinism," which reduces the extremely complex interdependencies between mankind and climate to an assumed unilateral effect of climate on mankind.[7] Thirdly, the social-constructivist research trend of recent decades supports the certainly justified negation of any determinism, including that based on climate.[8] However, we would be ill advised to characterize all factors that play a role in the living environment of humans as mere social constructs. An earthquake or a cold snap in summer is, of course, a social construct (all the more so if historians know of it only from the written historical record), but it is first and foremost a natural event with social consequences.

---

5 On stockyard fevers, see: Philip Slavin, The Great Bovine Pestilence and its economic and environmental consequences in England and Wales, 1318–50, in: The Economic History Review 65/4 (2012), pp. 1239–1266. On Florence: Gerrit Jasper Schenk, " ... prima ci fu la cagione de la mala provedenza de' Fiorentini ... ". Disaster and "Life world" – Reactions in the Commune of Florence to the Flood of November 1333, in: The Medieval History Journal 10 (2007), pp. 355–386. On St. Mary Magdalene's Flood: Martin Bauch, Die Magdalenenflut 1342 – ein unterschätztes Jahrtausendereignis? In: Mittelalter. Interdisziplinäre Forschung und Rezeptionsgeschichte, 04.02.2014 [http://mittelalter.hypotheses.org/3016 (12.11.2018)]; Id., Die Magdalenenflut 1342 am Schnittpunkt von Umwelt- und Infrastrukturgeschichte: Ein *compound event* als Taktgeber für mittelalterliche Infrastrukturentwicklung und Daseinsvorsorge?, in: NTM. Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin 27/3 (2019), pp. 273–309, DOI: 10.1007/s00048-019-00221-y]. On Basel: Werner Meyer, Da verfiele Basel überall. Das Basler Erdbeben von 1356. Mit einem geologischen Beitrag von Hans Peter Laubscher (Neujahrsblatt 184), Basel 2006. On Marcellus' Flood: Dirk Meier, "Es ist auß mit Euch vnd verloren mit dem Nordstrand", in: Gerrit Jasper Schenk et al. (ed.), Mensch. Natur. Katastrophe. Von Atlantis bis heute. Begleitband zur Sonderausstellung "Mensch. Natur. Katastrophe. Von Atlantis bis heute" (Publikationen der Reiss-Engelhorn-Museen 62), Regensburg 2014, pp. 172–179.

6 Émile DURKHEIM, Les règles de la méthode sociologique, Paris 1895, p. 135.

7 See Franz MAUELSHAGEN, Klimageschichte der Neuzeit 1500–1900, Darmstadt 2010, pp. 21–23.

8 On environmental determinism, see Ayichew K. Fekadu, The paradox in environmental determinism and possibilism: A literature review, in: Journal of Geography and Regional Planning 7/7 (2014), pp. 132–139.

As the German medievalist Peter Schuster pointed out twenty years ago, a culture-critical tendency to characterize the late Middle Ages as an era of deterioration and crisis has been evident in many studies since the 1920s.[9] Ironically, the Italian Renaissance is simultaneously celebrated as the cradle of modernity and florescence of art and culture.[10] In fact, older theories have increased their persuasive power only since 1929, against the background of the Great Depression. They draw connections between the Black Death, decreasing populations, deserted settlements, and an agrarian crisis which has mostly been characterized as a economic crisis or depression. The incomplete statistical foundations have contributed to disputes between different theoretical schools to explain economic cycles and depressions even today:[11]

The neo-Malthusians and the neo-Ricardian school (Wilhelm Abel, Michael Postan, George Duby) try to analyze the price-wage-spiral with the aid of a real economic perspective. The monetarists base their quantitative argumentation on decreasing silver production. Marxist researchers highlight a structural crisis within feudalism. Market economists point to a commercial revolution in the late Middle Ages, a market failure, or the influences of regulatory institutions. The American historian Barbara Tuchman compared the 1970s with the Vietnam War to the social unrest of the fourteenth century; the reflection in this "distant mirror" (as Tuchman titled her bestseller) showed that humanity had already coped with worse.[12] A very influential work on the fourteenth century as an era of crisis was published in 1987 by the Bohemian-German historian of Jewish origin František Graus (1921–1989),[13] who had survived three concentration camps and escaped in 1969 as an originally Marxist historian from the communists in the Czech Republic to West Germany. Graus believed that several sub-crises culminated in the fourteenth century, causing severe social disruption. In his view, which may well have been influenced by his own

9 Peter Schuster, Die Krise des Spätmittelalters. Zur Evidenz eines sozial-und wirtschaftsgeschichtlichen Paradigmas in der Geschichtsschreibung des 20. Jahrhunderts, in: Historische Zeitschrift 269 (1999), pp. 22–26; Schlögl (note 1) therefore analyzes crises as self-diagnosis. For older decadence theories, see Ulf Dirlmeier, Untersuchungen zu Einkommensverhältnissen und Lebenshaltungskosten in oberdeutschen Städten des Spätmittelalters (Mitte 14. bis Anfang 16. Jahrhundert) (Abhandlungen der Heidelberger Akademie der Wissenschaften, Philosophisch-Historische Klasse 1978,1), Heidelberg 1978, pp. 10–19.

10 Peter Burke, Die europäische Renaissance. Zentren und Peripherien, München 2005, pp. 70–75, 298–299.

11 Michael North, Europa expandiert 1250–1500 (Handbuch der Geschichte Europas 4), Stuttgart 2007, pp. 361–371, 438–442; Kitsikopoulos 2012/I (note 3); Richard Britnell, Commercialisation, Stagnation, and Crisis, 1250–1350, in: John Drendel (ed.), Crisis in the Later Middle Ages. Beyond the Postan-Duby Paradigm (The medieval countryside 13), Turnhout 2015, pp. 15–34.

12 Barbara Tuchman, Der ferne Spiegel. Das dramatische 14. Jahrhundert, München 1982, p. 9 (citations), pp. 37–55; subtitle in the English original: "The Calamitous 14th Century."

13 Graus (note 2); Guy P. Marchal, Nekrolog Professor František Graus (14. Dezember 1921 bis 1. Mai 1989), in: Schweizerische Zeitschrift für Geschichte 39 (1989), p. 237; Hans-Jörg Gilomen, Zum mediävistischen Werk von František Graus, in: Basler Zeitschrift für Geschichte und Altertumskunde 90 (1990), pp. 11–15.

biography, this tension resulted among other things in the flagellant movement and in anti-Semitic murders in the years following 1348.[14]

Ultimately, against the background of current climate change, natural factors are also discussed as a basic condition or deeper cause of the "crises" of the Middle Ages.[15] Most recent interdisciplinary research on global climate suggests an instable transition period between the different climate regimes of the Medieval Warm Period (about 950–1250) and the Little Ice Age (about 1450–1850).[16] In spite of existing uncertainties about the dynamics of the process and significant regional differences, this period seems to have been characterized by climatic variations with increasingly frequent and dramatic extreme events.

The interdependencies between natural environment and human activity need to be discussed in addition to weather and climate. Thus, the colonization period of the High Middle Ages, which led to enormous clearances, an expansion of farmland, and population growth, could have had long-term negative effects on the water balance and soil erosion, which in turn could result in decreased harvests and diminished resistance to epidemics and insects.[17] It is an unanswered question as to whether and to what extent we can talk about anthropogene effects on weather patterns or even climatic development at the regional or continental level as soon as the late Middle Ages or even earlier. The famine crisis from 1315 to 1322, which was obviously not limited to northwestern Europe, the cattle fever starting in 1318, and, last but not least, the bad harvests and years of scarcity in the 1340s in Central Italy seem to correlate with a worsening climate (wet and cold summers); these agrarian crises were accompanied by epidemics

14 Graus (note 2), p. 387 suggests that anti-Semitic violence served as "Ventil" (an outlet) for all kinds of retained emotional tension.

15 Werner Rösener, Die Krise des Spätmittelalters in neuer Perspektive, in: Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte 99/2 (2012), pp. 189–208; Bruce M. S. Campbell, Nature as historical protagonist: environment and society in pre-industrial England, in: The Economic History Review 63/2 (2010), pp. 281–314; Bruce M. S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval World, Cambridge, New York, Port Melbourne 2016; see also Rainer Schreg's contribution to this volume.

16 Valérie Masson-Delmotte/ Michael Schulz (eds.), Chapter 5: Information from Paleoclimate Archives, in: Thomas F. Stocker et al. (ed.), Climate change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, New York 2013, pp. 383–464, here pp. 409–415 [https://www.ipcc.ch/report/ar5/wg1/ (12.12.2015)]. Debate: Malcolm K. Hughes/ Henry F. Diaz, The Medieval Warm Period, in: Malcolm K. Hughes/ Henry F. Diaz (eds.), Climatic Change 26/2–3 (1994), pp. 109–142; Rösener 2010 (note 3); Morgan Kelly/ Cormac Ó Gráda, Debating the Little Ice Age, in: Journal of Interdisciplinary History 45/1 (2014), pp. 57–68.

17 Compare Harry Kitsikopoulos's introductory comments in Id. (ed.), Agrarian Change and Crisis in Europe, 1200–1500 (Routledge Research in Medieval Studies 1), New York, London 2012, pp. 8–9.

and had weakened the population prior to the arrival of the Black Death in 1347. The intensifying meteorological extreme events hit an increasingly vulnerable society.[18]

We could retain the old juxtaposition of Charles P. Snow's "two cultures"[19] in which humanists deconstruct the "Crisis of the Late Middle Ages" while scientists point to an ever-growing amount of evidence on climatic instability and meteorological extreme events even as their assumptions about the consequences remain all too often characterized by determinism. Instead of playing off different types of evidence from disciplines that seem to have nothing in common, however, one could take advantage of at least the shared interest in the same objects of research, be it periods, processes, or single events. It was the nineteenth-century philosopher William Whewell (1794–1866) who first described the "unexpected coincidences of results drawn from distant parts of a subject"[20]; in 1998, the evolutionary biologist Edmund O. Wilson named this concept "consilience", literally a kind of "jumping together" and defined it as an agreement of inductions based on at least two epistemologically different sources of data.[21] His work, despite its popularity and the fact that this approach is implicitly

18 On the cold wave 1315–1321 ("*Dantean anomaly*"), see Neville Brown, History and Climate Change. A Eurocentric perspective (Routledge Studies in Physical Geography and Environment 3), London, New York 2001, pp. 251–254; András Vadas, Documentary evidence on weather conditions and a possible crisis in 1315–1321: Case study from the Carpathian basin, in: Journal of Environmental Geography 2 (2009), pp. 23–29. The most recent overview by Philip Slavin, The 1310s Event, in: Sam White/ Christian Pfister/ Franz Mauelshagen (eds.), The Palgrave Handbook of Climate History, London 2018, pp. 495–516. On weather and climate from 1340–1350, see Pierre Alexandre, Le Climat en Europe au Moyen Âge. Contribution à l'histoire des variations climatiques de 1000 à 1425, d'après les sources narratives de l'Europe occidentale (Recherches d'histoire et de sciences sociales 24), Paris 1987, pp. 802–803; Christian Pfister, Variations in the Spring-Summer Climate of Central Europe from the High Middle Ages to 1850, in: Heinz Wanner/ Ulrich Siegenthaler (eds.), Long and Short Term variability of Climate (Lecture notes in earth sciences 16), Berlin 1988, pp. 66–67, 71–72 ("Ice Age Summers of the 1340's"); Christian Pfister, Historische Umweltforschung und Klimageschichte. Mit besonderer Berücksichtigung des Hoch-und Spätmittelalters, in: Siedlungsforschung. Archäologie – Geschichte – Geographie 6 (1988), pp. 122–123. On Italy, see Emanuela Guidoboni/ Antonio Navarra/ Enzo Boschi, The Spiral of Climate. Civilizations of the Mediterranean and Climate Change in History, Bologna 2011, pp. 130–139. On the hunger crisis, stockyard fever, and the locally varying consequences, see William Chester Jordan, The Great Famine. Northern Europe in the Early fourteenth century, Princeton 1996; Heli Huhtamaa, Climate, Conflicts and Crises. Temperature variations in relation to violent conflict, subsistence crisis, and social struggle in Novgorod and Lagoda region AD 1100–1500. (Master thesis) Finland 2012 [http://epublications.uef.fi/pub/urn_nbn_fi_uef-201220493/ (21.11.2015)], pp. 41–42, 44–46; Sharon Dewitte/ Philip Slavin, Between Famine and Death: England on the Eve of the Black Death – Evidence from Paleoepidemiology and Manorial Accounts, in: Journal of Interdisciplinary History 44/1 (2013), pp. 37–60.

19 Charles P. Snow, Two Cultures and the Scientific Revolution, New York 1959.

20 William Whewell, The Philosophy of the Inductive Sciences: Founded upon their History, 2 vols, London 1840, here: vol. 2, p. 232.

21 Edward Wilson, Consilience: The Unity of Knowledge, New York 1998.

familiar to any researcher, was only reluctantly received in the the humanites.[22] It was the American medievalist Michael Mc Cormick who introduced it, in a decisively positive interpretation in 2011, as it seemed particularly fit to embrace a confluence of scientific and historical studies with regard to the interplay of paleoclimate and history.[23] Finally, in 2016, interdisciplinary cooperation with the declared goal of consilience resulted in a volume[24] on the climate of the Mediterranean during the Holocene in which the Byzantinist Adam Izdebski and others argue that the methodological gaps between historical scholarship, archeology, and paleoclimatic sciences are not as difficult to bridge as one might think: interdisciplinary research does require that the scholars within these disciplines find a common language and fairly distribute influence on the design of research agendas and the evaluation of research impacts.[25]

Scholars welcomed this approach as "the next phase in the evolution of premodern environmental history – interdisciplinary historians working in multidisciplinary teams."[26] The present volume – while not yet fulfulling all the requirements of a consilient "archeoscience of the human past"[27] – tries to make an interesting contribution: Tim Newfield and Inga Labuhn argue for a focus on epochs for which both data for the natural and cultural sciences is dense. This allows for a more balanced evaluation of single factors, and cross-disciplinary research should prove particularly effective in countering the danger of environmental determinism.[28] In the case of the crisis of the fourteenth century, consilience should encourage historians to transcend the internal discourses of their disciplines without forgetting these. Intradisciplinary conversations may still prove useful to curb the sometimes effervescent enthusiasm[29] about the new possibilities of this interdisciplinary research.

---

22 Edward Slingerland/ Mark Collard, Introduction, in: Id./ Id. (eds.), Creating Consilience: Integrating the Sciences and the Humanities, Oxford et al. 2012, pp. 3–40.

23 Michael Mc Cormick, History's Changing Climate: Climate Science, Genomics, and the Emerging Consilient Approach to Interdisciplinary History, in: Journal of Interdisciplinary History 42/2 (2011), pp. 251–273, here p. 257.

24 Alexandra Gogou/ Adam Izdebski/ Karin Holmgren (eds.), Mediterranean Holocene Climate, Environment and Human Societies (Quaternary Science Reviews 136), Amsterdam et al. 2016.

25 Adam Izdebski et al., Realizing consilience: How better communication between archeologists, historians and natural scientists can transform the study of past climate change in the Mediterranean, in: Gogou/ Izdebski/ Holmgren (note 24), pp. 5–22.

26 Tim P. Newfield/ Inga Labuhn, Realizing Consilience in Studies of Pre-Industrial Climate and Pre-Laboratory Disease, in: Journal of Interdisciplinary History 48/2 (2017), pp. 211–240, here p. 212.

27 Mc Cormick (note 23), p. 256.

28 Newfield/ Labuhn (note 26), pp. 214, 216, 220; a critical comment on the debate by Martin Bauch, *consilience* in der Vormoderne – Anmerkungen aus der Klimageschichte, in: NTM. Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin 27/2 (2019), pp. 185–192.

29 Stephan Ebert, Vulkane in der Umweltgeschichte oder das Problem der "Euphorie der Erkenntnis", in: Mittelalter. Interdisziplinäre Forschung und Rezeptionsgeschichte, 03.02.2016 [http://mittelalter.hypotheses.org/7685].

Recent research applies not only the term "vulnerability" but also the complementary concept of "resilience" as an analytical key difference.[30] The "vulnerability" of societies was established as a concept in the discourse of development policy and disaster research. This approach, which involves measuring the systemic (i.e. material, social and cognitive) vulnerability of societies against threats in a causal and gradual manner,[31] has in the meantime also been applied to analyze infrastructure systems, despite some criticism.[32] "Vulnerability" as a concept examines, for example, social conditions and processes and how these influenced whole societies – or segments thereof – and their ability to respond to dangers and catastrophes.[33] From a historical point of view, the concept builds a methodological bridge between natural sciences, engineering, social sciences, and cultural studies.[34]

As a counter term, the concept of "resilience" – drawn originally from ecology and psychology – describes how well a system tolerates disturbance.[35] "Resilient"

30 Gilberto C. Gallopín, Linkages between vulnerability, resilience, and adaptive capacity, in: Global Environmental Change 16 (2006) pp. 293–303.

31 Ben Wisner et al. (eds.), At Risk. Natural hazards, people's vulnerability and disasters, London, New York 2004, pp. 11–16, 49–86; cf. also the articles in Greg Bankoff/ Georg Frerks/ Dorothea Hilhorst (eds.), Mapping Vulnerability. Disasters, Development and People, London 2004; also Hans-Georg Bohle/ Thomas Glade, Vulnerabilitätskonzepte in Sozial-und Naturwissenschaften, in: Carsten Felgentreff/ Thomas Glade (eds.), Naturrisiken und Sozialkatastrophen, Berlin, Heidelberg 2008, pp. 99–116. Steven Engler's model to quantify vulnerability to famine is overly simplified: he applies on the one hand a numerical indexing system for fundamentally different factors, resulting in their having the same (quality) effect. On the other hand, his method tends to be too subjective to add and calculate singular factors – many of which are closely related (e.g. in a causal relationship). This oversimplification of the complex and specific reality of every single case casts doubt on the validity of any conclusions thus reached. Steven Engler, Developing a historically based "Famine Vulnerability Analysis Model" (FVAM) – an interdisciplinary approach, in: Erdkunde 66/2 (2012), pp. 157–172.

32 Sara Bouchon, L'application du concept de vulnérabilité aux infrastructures critiques: quelles implications pour la gestion territoriale des risques?, in: Responsabilité et Environnement. Recherches, débats, actions 43 (Juillet 2006), pp. 35–41; Hans-Joachim Bürkner, Vulnerabilität und Resilienz. Forschungsstand und sozialwissenschaftliche Untersuchungsperspektiven (Working Paper des Leibniz-Instituts für Regionalentwicklung und Strukturplanung 43), Erkner 2010.

33 Jörn Birkmann et al. (eds.), Indikatoren zur Abschätzung von Vulnerabilität und Bewältigungspotenzialen am Beispiel von wasserbezogenen Naturgefahren in urbanen Räumen (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, Schriftenreihe Forschung im Bevölkerungsschutz 13), Bonn 2011, here p. 25; Jörn Birkmann et al. (eds.), Extreme Events, Critical Infrastructures, Human Vulnerability and Strategic Planning: Emerging Research Issues, in: Extreme Events 3/2 (2016), pp. 1650017-1 – 1650016-25.

34 Dominik Collet argues for using "vulnerability" as a boundary object in the research on hunger crises. Collet, "Vulnerabilität" als Brückenkonzept der Hungerforschung, in: Dominik Collet/ Thore Lassen/ Ansgar Schanbacher (eds.), Handeln in Hungerkrisen. Neue Perspektiven auf soziale und klimatische Vulnerabilität, Göttingen 2012, pp. 13–25.

35 Carl Folke et al., Resilience. The Emergence of a Perspective for Social-Ecological Systems Analyzes, in: Global Environmental Change 16/3 (2006), pp. 253–267. For a sociological and historical perspective on the concept see contributions in: Lukas Clemens/ Martin Endress (eds.), Strategies, Dispositions and Resources of Social Resilience. A Dialogue between Medieval Studies and Sociology [in print 2019].

means that in times of crisis, the system remains functional, reacting dynamically and flexibly in terms of time and space. In other words, it has a certain ability to resist and adapt.[36] There are three types of resilience: 1) resistance: the precautions a system takes to withstand shocks or creeping changes; 2) recovery: the capacity of a system to recover and bounce back to the original condition relatively quickly, to react appropriately to disturbances and to absorb them; 3) creativity: the ability of a system to achieve the highest possible level of functionality and protection by adapting to the changing conditions.[37] Although the concept is marked by modern political and cultural assumptions,[38] is at times conceptually imprecise,[39] and is difficult to apply directly to historical societies and their infrastructures, the key difference between "vulnerability" and "resilience" allows for a more precise analysis of historical societies and their reactions to dangers, threats and catastrophes.

From this perspective, the following simple questions arise and reoccur in this volume: What strategies did societies develop to protect themselves? Did they prepare themselves in the face of inevitable dangers or even make catastrophic cuts in the interest of disaster preparedness? Or did they try to avoid disturbances and threats in the first place by taking steps in the sense of disaster prevention?[40] There are many examples of societies across time and space that anticipated disturbances and dangers and prepared themselves accordingly.

The question of how societies dealt with very gradual changes, such as large-scale environmental and climate change and even more so the meteorological effects of changing ocean currents or major volcanic eruptions on the other side of the world,

36 In addition to Folke et al. (note 35): Andrew Zolli/ Ann Marie Healy, Resilience. Why Things Bounce Back, New York 2012.

37 See Brigit Maguire/ Patrick Hagan, Disasters and Communities: Understanding Social Resilience, in: The Australian Journal of Emergency Management 22/2 (2007), pp. 16–20.

38 Recently Sabine Höhler, Resilienz: Mensch – Umwelt – System. Eine Geschichte der Stressbewältigung von der Erholung zur Selbstoptimierung, in: Zeithistorische Forschungen 11 (2014), pp. 425–443, also Leon Hempel/ Daniel F. Lorenz, Resilience as an Element of a Sociology of Expression, in: Behemoth – Journal on Civilization 7/2 (2014), pp. 26–72.

39 Martin Endress/ Benjamin Rampp, Resilienz als Prozess transformativer Autogenese. Schritte zu einer soziologischen Theorie, in: Behemoth 7/2 (2014), pp. 73–102.

40 For more information on the two aspects of preparedness and prevention, which cannot be separated accurately and should be understood as complementary strategies for dealing with specific hazards, see Stephen J. Collier/ Andrew Lakoff, Infrastructure and Event: The Political Technology of Preparedness, in: Bruce Braun/ Sarah Whatmore (eds.), The Stuff of Politics. Technoscience, Democracy, and Public Life, Minneapolis 2010, pp. 243–266; Will Medd/ Simon Marvin, From the Politics of Urgency to the Governance of Preparedness: A Research Agenda on Urban Vulnerability, in: Journal of Contingencies and Crisis Management 13/2 (2005), pp. 44–49; James Brassett/ Nick Vaughan-Williams, Security and the performative politics of resilience: Critical infrastructure protection and humanitarian emergency preparedness, in: Security Dialogue 46/1 (2015), pp. 32–50.

which can extend over several years, has been addressed only to a limited extent.[41] In most cases, it is not clear whether contemporaries were aware of these processes of change, and, even if they were, they probably did not detect or understand their actual cause. Nevertheless, the changes, especially whenever these were of an eventful character (e.g., natural extreme events such as storms, drought, floods), challenged people to find explanations, as changes in nature have often been understood as "God's book" and interpreted as the Creator's signs to the faithful.[42] Whether their origin was known or not, these "natural" factors had dynamic effects on the "societal relationship with nature"[43] and are therefore historically relevant elements which scholars should address in their research.

There are two contrasting approaches to this historical source material: on the one hand, scholars employ an emic approach when they analyze contemporary accounts with particular attention given to the respective time horizon.[44] In this case, researchers are especially mindful of the specific world view of contemporaries and their respective social reactions. These source-critical methods make it possible to glean information from other, non-narrative forms of documentation, such as invoices and inventories, by considering their communicative purposes (Maximilian Schuh, Peter Brown). On the other hand, scientists sometimes adopt an etical approach in which they rely on sources to describe past events and processes such as large-scale weather conditions and climatic fluctuations. These follow patterns that can be explained and based on rules using natural scientific methods.[45] Ideally, scholarship combines these

41 Martin Kappas, Klimatologie. Klimaforschung im 21. Jahrhundert – Herausforderung für Natur- und Sozialwissenschaften, Heidelberg 2009, pp. 121–142.

42 Gerrit Jasper Schenk, Lektüren im "Buch der Natur". Wahrnehmung, Beschreibung und Deutung von Naturkatastrophen, in: Susanne Rau/ Birgit Studt (eds.), Geschichte schreiben. Ein Quellen- und Studienhandbuch zur Historiographie (ca. 1350–1750), Berlin 2010, pp. 507–521.

43 On the concept, see Michael Weingarten, Die Krise der gesellschaftlichen Naturverhältnisse. Annäherung an die kulturell konstituierende Differenzierung von Natur und Kultur, in: Dirk Hartmann/ Peter Janich (eds.), Die Kulturhistorische Wende. Zur Orientierung des philosophischen Selbstverständnisses, Frankfurt 1998, pp. 371–414; Gerrit Jasper Schenk, Historical Disaster Experiences. First Steps toward a Comparative and Transcultural History of Disasters across Asia and Europe in the Preindustrial Era, in: Gerrit Jasper Schenk (ed.), Historical Disaster Experiences. Towards a Comparative and Transcultural History of Disasters Across Asia and Europe, Cham 2017, pp. 3–44, here pp. 3, 13–15. It is telling that the editors of a anthology on "the natural world in medieval and early modern Europe" characterize this conceptual and methodological diversity as a strength of their volume, given the conceptual diversity in dealing with "nature" and "culture" in the individual contributions, Barbara A. Hanawalt/ Lisa J. Kiser, Introduction, in: Ead./ Ead. (eds.), Engaging with Nature. Essays on the Natural World in Medieval and Early Modern Europe, Notre Dame / Indiana 2008, pp. 1–10, here p. 4.

44 Recent research on historical catastrophes has not limited itself, but prefers this emic perspective, cf. the latest research review of Schenk, Historical Disaster Experiences (note 43), p. 4–15, 23–35.

45 For more information on this epistemically different methodological approach, see Gerrit Jasper Schenk, "Learning from History"? Chances, problems and limits of learning from historical natural disasters, in: Fred Krüger et al. (eds.), Cultures and Disasters. Understanding Cultural Framings in Disaster Risk Reduction, London, New York 2015, pp. 72–87, here pp. 78–82; and more in Id.,

two methodological approaches: the emic perspective is essential to appraise the value and validity of first-hand accounts when reconstructing such weather events, for example. A more straight-forward etic reading of chronicles and calculations, however, lends itself to statistical analysis of precipitation and temperatures, crop yields, and prices, which can be evaluated and combied with dendrochronological data, for example, to reconstruct past weather patterns (Thomas Labbé, Heli Huhtamaa). It is only against this background that contemporary reactions, with their numerous interactions between "nature" and "society," become recognizable and interpretable.

In understanding the dynamic relationship between societies and their natural environment, a heuristic method has proven to be a fruitful approach in ecological and environmental history research for decades.[46] Researchers have based their ideal-typical models on considerations in the sense of systems theory; a few examples here are intended to provide a basic outline of these models as a basis for the concept of both natural and social teleconnections developed in this volume. We begin with those models that have less heuristic potential. While all models are abstractions and thus intrinsically interpret a "reality," based on source analysis, observations, calculations and considerations, they can be tested using concrete case studies.[47]

In his study on "ecological communication," Niklas Luhmann describes society as a "system of communication" in which "nature" is perceived as an impulse of the "environment" (i.e., the surroundings) of the system only if this impulse can be incorporated into the internal communication within the system and creates "resonance"

Aus der Geschichte lernen? Chancen, Probleme und Grenzen des Lernens aus der Geschichte von "Natur"-Katastrophen, in: Margit Mersch (eds.), Mensch – Natur – Wechselwirkungen in der Vormoderne. Beiträge zur mittelalterlichen und frühneuzeitlichen Umweltgeschichte, Göttingen 2016, pp. 39–72, here pp. 55–60; lastly Id., Sulla necessità di rendere proficua la memoria dei terremoti e sulla problematicità di trarre insegnamenti dalla loro storia. Un commento alle riflessioni di Emanuela Guidoboni, in: Quellen und Forschungen aus italienischen Archiven und Bibliotheken 96 (2016), pp. 245–254.

46 On the ecological modeling, which tried to explain the development of mankind and his cultural evolution, see as early as 1978, Kenneth E. Boulding, Ecodynamics. A New Theory of Societal Evolution, Beverly Hills, London 1978; an overview in Antoinette M. Mannion, Global Environmental Change, New York [2]1997, pp. 1–11; from the perspective of environmental history, see Verena Winiwarter/ Martin Knoll, Umweltgeschichte. Eine Einführung, Köln, Weimar, Wien 2007, pp. 117–143. This is to point out once again that the terms "nature" and "society" are only applied in an ideal-typical context, and that they are so closely related to each other that an ideal-typical separation only makes sense for analytical reasons.

47 On the role of abstract concepts and models, which archaeologists have already accepted more readily than historians, see Detlev Gronenborn/ Rainer Schreg, Krisen und ihre Bewältigung – Aspekte einer Bilanz, in: Falko Daim/ Detlev Gronenborn/ Rainer Schreg (eds.), Strategien zum Überleben. Umweltkrisen und ihre Bewältigung. Tagung des Römisch-Germanischen Zentralmuseums, 19. / 20. September 2008 (Römisch-Germanisches Zentralmuseum Mainz, Tagungen 11), Mainz 2011, pp. 303–310, here pp. 304–305.

there.[48] If, however, one considers the system-environment (i.e. in this case "nature") to be connected to and co-evolving with the system of society,[49] these historical relationships may be analyzed even in cases where there is no record of overt communication in society concerning environmental changes; these occurred nevertheless and altered in turn the society's relationship to nature. Rigorously demarcating the boundaries between "system" (i.e. "society") and "system-environment" (i.e. "nature") in Luhmann's sense therefore blocks a heuristic approach that seeks to identify and investigate interdependencies and feedback loops between the (communication) system and the system-environment in the past.

The so-called "Gaia hypothesis" – formulated by the physician and biophysicist James Lovelock and biologist Lynn Margulis and sold in bestsellers that include an esoteric element – takes an extreme approach in the opposite direction.[50] Lovelock and Margulis suggest that the whole earth be regarded as a self-regulatory living being (superorganism). Unfortunately, the authors apply this image not to actual superorganisms that could be investigated but to the totality of the earth as such and thereby impede any scientific usefulness of the metaphor. As a result, a number of biologists and ecologists have rejected the Gaia hypothesis.[51] However, the controversy surrounding the Gaia hypothesis (which cannot be included in this discussion) has recently led to a systems theory understanding of the earth as a slowly developing totality of biotic and abiotic elements which interact with each other in a sort of self-regulation; scientists remain divided on the question of whether these elements actually co-evolve and whether the process strives for homeostatic states.[52] Within the context of Bruno Latour's actor-network theory, which similarly ascribes agency to abiotic elements, the French sociologist of science has recently made some affirm-

48 Niklas Luhmann, Ökologische Kommunikation. Kann die moderne Gesellschaft sich auf ökologische Gefährdungen einstellen?, Wiesbaden [4]2004, pp. 97–98, 210, 218–226. Also critical to his theoretical development Djongkil Kim, Zur Theorie der Moderne "Ungleichzeitigkeit des Gleichzeitigen". Ein Beitrag zur Diskussion um die Moderne in soziologischen Gesellschaftstheorien, Göttingen 1993, pp. 43–51, 144–149.

49 On co-evolution Winiwarter/ Knoll (note 46), pp. 137–140, 244–245.

50 First mentioned in James E. Lovelock/ Lynn Margulis, Atmospheric homeostasis by and for the biosphere: the gaia hypothesis, in: Tellus. A bi-monthly journal of geographics 26/1–2 (1974), pp. 1–10; and developed in many contributions and books including James E. Lovelock, Gaia. A new look at life on Earth, Oxford et al. 1979.

51 Wolfgang Nentwig et al. (eds.), Ökologie, Heidelberg, Berlin 2004, pp. 424–432; Katharina Munk (ed.), Ökologie – Evolution, Stuttgart et al. 2009, p. 188; Ludwig Trepl, Die Erde ist kein Lebewesen –Kritik der Gaia-Hypothese (Blog Landschaft & Oekologie, 13 February 2013) [https://scilogs.spektrum.de/landschaft-oekologie/die-erde-ist-kein-lebewesen-beitrag-zur-kritik-der-gaia-hypothese/ (2017–12–17)].

52 See Nadja Podbregar, Organismus Erde? Von der Gaia-Hypothese zum System Erde, in: Id./ Dieter Lohmann (eds.), Im Fokus: Geowissen. Wie funktioniert unser Planet?, Berlin, Heidelberg 2013, pp. 153–160; Arno Bammé, Geosoziologie. Gesellschaft neu denken, Marburg 2016, pp. 59–62; Toby Tirell, On Gaia. A Critical Investigation of the Relationship between Life and Earth, Princeton 2013, pp. 199–218.

ative comments about Lovelock's Gaia hypothesis.[53] While we recognize the importance of addressing socio-ecological systems in a way which includes abiotic factors (such as weather, volcanism, etc.) as part of these processes, we reject the organic implications of the Gaia hypothesis.

Socio-ecological system theories, which fall between the two extremes outlined above, have been developed and used, for example, in the "Vienna and Klagenfurt School" around Marina Fischer-Kowalski and Verena Winiwarter, the prominent ecologists whose widely received scholarship has influenced, for example, the Canadian medievalist Richard C. Hoffmann.[54] The starting point here, too, is the assumption of a complex systemic relationship between the inanimate and animate world, of which human societies are only one element. By analyzing the interactions within this system, the exchange relationships and material flows, it is possible, for example, to reach conclusions about the energy regime of societies (the so-called "social metabolism").[55] This model can be related to very different "socio-natural sites" and is therefore scalable and specific (Theodore R. Schatzki, Martin Knoll).[56] An interdisciplinary working group around the environmental biologists Lance H. Gunderson and Crawford S. Holling has developed an even more complex system theory in its Panarchy model.[57] This all-encompassing heterarchical network model facilitates the mapping of transformations within socio-ecological systems.[58] This model is scalable and can incorporate both adaptive processes as well as non-linear developments (e. g. disruptive events like disasters).

---

53 Bruno Latour, Kampf um Gaia. Acht Vorträge über das neue Klimaregime, Berlin 2017, pp. 148–149, 152–154 (here on the antisystemic character of the Gaia hypothesis), pp. 484–486.

54 See Marina Fischer-Kowalski et al. (eds.), Gesellschaftlicher Stoffwechsel und Kolonisierung von Natur. Ein Versuch in sozialer Ökologie, Amsterdam 1997; Verena Winiwarter/ Martin Schmid, Umweltgeschichte als Untersuchung sozionaturaler Schauplätze? Ein Versuch, Johannes Colers "Oeconomie" umwelthistorisch zu interpretieren, in: Thomas Knopf (ed.), Umweltverhalten in Geschichte und Gegenwart. Vergleichende Ansätze, Tübingen 2008, pp. 158–173; Richard C. Hoffmann, An Environmental History of Medieval Europe, Cambridge 2014, pp. 6–16.

55 Verena Winiwarter/ Christoph Sonnlechner, Der soziale Metabolismus der vorindustriellen Landwirtschaft in Europa (Der Europäische Sonderweg 2), Stuttgart 2001; examples: Christoph Sonnlechner, Verwaltung von Natur. Ressourcenmanagement und das geschriebene Wort in spätmittelalterlichen und frühneuzeitlichen Grundherrschaften, in: Walter Pohl (ed.), Vom Nutzen des Schreibens. Soziales Gedächtnis, Herrschaft und Besitz im Mittelalter (Forschungen zur Geschichte des Mittelalters 5; Österreichische Akademie der Wissenschaften, Philosophisch-historische Klasse, Denkschriften 306), Wien 2002, pp. 375–396; Christian Zumbrägel, Die vorindustriellen Holzströme Wiens: Ein sozionaturales großtechnisches System? in: Technikgeschichte 81 (2014), pp. 335–362.

56 Theodore R. Schatzki, Nature and technology in history, in: History and Theory 42 (2003), pp. 82–93; Martin Knoll, Die Natur der menschlichen Welt. Siedlung, Territorium und Umwelt in der historisch-topografischen Literatur der Frühen Neuzeit, Bielefeld 2013, pp. 92–107.

57 Lance H. Gunderson/ C. S. Holling (eds.), Panarchy. Understanding Transformations in Human and Natural Systems, Washington, Covelo, London 2002.

58 Nicholas M. Gotts, Resilience, panarchy, and world-systems analysis, in: Ecology and Society 12/1 (2007), p. 24. [URL: http://www.ecologyandsociety.org/vol12/iss1/art24/ (2017–12–06)].

None of these concepts and models are the focus of the present volume, but they do provide the conceptual and hypothetical framework for examining the questions posed here. Analyzing the interaction between the ideal types "nature" and "society" in space and time raises methodological problems beyond the abstract models, mainly concerning the verifiability and the type of interaction or form of the interrelationships between the ideal types "nature" and "society." Are observable environmental phenomena like cool, wet weather during the growth period and (possibly remote) supply crises merely coincidential or are they causally related? What is the epistemic status of correlations and the legitimacy of connecting temporal and spatially removed events? Is there a point at which quantitative arguments[59] and correlations of more or less connected events have to be interpreted as causal connections? On the one hand a succession of bad summers certainly does not explain the visions of someone like Dante Alighieri sufficiently, but, on the other hand, Giovanni Boccaccio's entertaining novelettes are more than an escapist diversion in the period of the Black Death – the entertaining diversion is intended to be medicine against bad humors (in the sense of humoral pathology). The complex interdependencies between environment and society defy easy explanations; we have to assume that the products of high culture also possessed a great deal of *Welthaltigkeit*; in other words, they contain parts of their creators' physical realities. To summarize the results of this overview of approaches for the study of environmental history, a pragmatic heuristical approach should display the following traits:

- Openness to data from human-made sources as well als proxy data of scientific origin, and consideration of possible contradictions
- Attentive to the sensitivity/liability of social groups to external shocks without underscoring potential tolerance to these shocks or an ability to resist that some segments of a society may have
- Consideration of the temporal dimension of these external shocks, be they rapid or slow, singular or repeated events
- No blind dependence on communication about nature within a given society (although this might be an aspect) but rather an understanding that some changes take place although contemporaries remain unaware of them (e.g., climate change and shifting baselines[60])
- Focus on the interactions, exchanges, and material flows between the living and the non-living world following the Vienna School's model (scalable both geographically – i.e., applicable to local, regional, continental and global phenomena – and chronologically – i.e., covering periods from several days to decades, if not centuries)

59 On the problems of quantitative arguing, see already Gerd Wunder, Menschen und Zahlen. Bemerkungen zur quantifizierenden Methode, in: Kuno Ulshöfer (ed.), Bauer, Bürger, Edelmann. Ausgewählte Aufsätze zur Sozialgeschichte von Gerd Wunder. Festgabe zu seinem 75. Geburtstag (Forschungen aus Württembergisch Franken 25), Sigmaringen 1991, pp. 19–25, here pp. 23–24.

60 See Dietmar Rost, Wandel (v)erkennen. Shifting baselines und die Wahrnehmung umweltrelevanter Veränderungen aus wissenssoziologischer Sicht, Wiesbaden 2014, pp. 101–118.

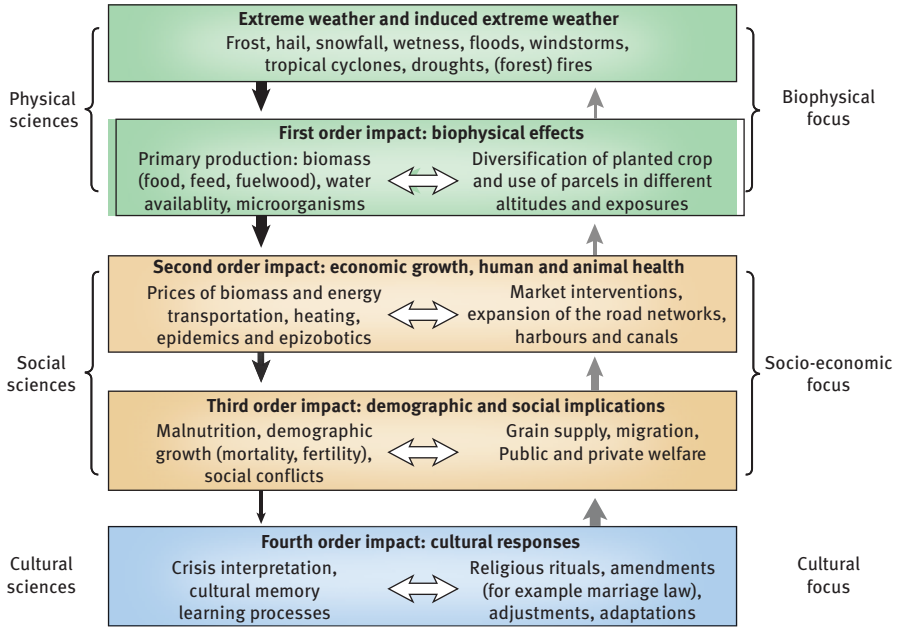

Figure 1: Climate and societal interactions in model visualizing cascading effects of extreme events on societies (black arrows) and societal adaption strategies (grey arrows), Source: Luterbacher/ Pfister, (note 61), p. 248, figure 2.

Because most of the contributions in this volume focus on phenomena more or less associated with historical climate change, it seems reasonable to introduce the pragmatic impact-reaction model that Daniel Krämer and Christian Pfister proposed to conceptualize the interactions of meteorological extreme events and societal change.[61]

While this model (Figure 1) seems to include a number of the traits discussed above, it focuses nearly exclusively on the idea of an "impact" of natural events: these impacts are implicity understood as short-term, immediate, and locally bound, and the cascading effects from one level to another can explain quite a lot in most of the thinkable case studies.

But this model has its flaws, as well: there are at least three aspects in which this scheme of impact/ reaction cannot sufficiently explain what can be empirically found:

61 Daniel Krämer, "Menschen grasten mit dem Vieh". Die letzte grosse Hungerkrise der Schweiz 1816/1817, Basel 2015, p. 136; Christian Pfister, Climatic Extremes, Recurrent Crises and Witch Hunts. Strategies of European Societies in Coping with Exogenous Shocks in the Late Sixteenth and Early Seventeenth Centuries, in: The Medieval History Journal 10/1–2 (2007), pp. 33–73, here pp. 41–43; most recent version of the model: Jürg Luterbacher/ Christian Pfister, The year without a summer, in: Nature Geoscience 8 (2015), pp. 246–248, here p. 248, Figure 2.

1. ***Impacts can skip the logical order of levels***, from biophysical effects to economy/ health to demography/ society to, finally, culture. For example, the mere anticipation of extreme weather sometimes impacts food prices even if no serious damage actually occurs.
2. ***Delayed effects and feedback loops***: Impacts repeat on one level (mainly biophysical/ economic), but the consequences at other levels emerge only after a – sometimes considerable – time lag, often long after the original extreme event has ended. For example, societies might introduce delayed institutional or infrastructural adaptations in the areas of flood protection or food security.
3. ***Spatial crosslinks***: The impact of extreme events on different levels can also happen in differing geographic regions: it gets projected from one area to another, as long as they are somehow connected. This might be a physical connection, like the flooding along the lower stretch of a stream while the flood wave originated in the headwaters of the river, where extreme precipitation took place. Also social connections are thinkable: for example, inclement weather in a grain-producing area impacts the harvest and causes dearth or even famine in a far away city or region that depends on imports from that very area of grain production.

A combination of all three aspects is also feasible. For example, the cult of a protective saint against the plague spreads in a European region hardly affected by the Black Death, even as the pandemic itself was sparked in part by changing precipitation patterns in Central Asia.

Perhaps it is more useful to think of the multi-level impacts of a meteorological extreme event on a society (as the sole or contributory factors) as a social equivalent to what climatologists define as an oscillation: atmospheric phenomena that tend to vary above or below a mean value, in most of the cases in a periodic way.[62] There is a variety of oscillation types[63] as it might seem useful to re-categorize impacts based on their frequency and strength. The methodological approach proposed in more detail below, especially when it applied to the longue durée or at least multi-annual analysis, is comparable to what climatologists do.[64]

---

62 A perfect periodicity would be described as a cycle, but this applies only to few atmospheric oscillations, see Howard A. Bridgman/ John E. Oliver, The Global Climate System. Patterns, Processes, and Teleconnections, Cambridge 2006, pp. 25–26.

63 There is a multitude of different categories, e.g. a damped oscillation with constantly decreasing amplitude; a persisant oscillation that maintains its amplitude; an unstable oscillation with an amplitude that grows and then breaks down. A forced oscillation is set up periodically by an external force, while a free oscillation receives only initial external energy to set in place a certain motion, see Rhodes W. Fairbridge, Oscillations, in: John E. Oliver/ Rhodes W. Fairbridge (eds.), The Encyclopedia of Climatology, New York 1987, pp. 643–644.

64 "The character of the identified oscillations is mostly derived statistically from long-term pressure observation series" (Bridgman/ Oliver [note 62], p. 26).

And yet is it not enough to add the idea of oscillation to our often fairly unnuanced notion of "impact." If we want to describe the "long arm of climate change" in historical research, it is useful to adopt the term of "societal teleconnection", broadly defined as "mechanisms that produce inter-dependence in the vulnerabilities of ecosystems, people, and places".[65] Originally, the term "teleconnection" described the tendency for atmospheric circulation patterns to be related over large, not necessarily connected, areas.[66] Significantly, the origins of meteorological theories on long-distance connections between meteorological events were caused by observations of the social impact of weather events. The first scholars to develop such hypotheses have been English metereologists in the service of the Indian Meteorological Department in the second half of the nineteenth century; they noted that snowfall in the Himalayas correlated to droughts in India, which repeatedly caused threatening famines.[67] In the early twentieth century, systematic statistical analysis verified global correlations and weather patterns ("Yule-Walker equations").[68] As such, teleconnections became strongly associated with atmospheric oscillations.[69] Teleconnections "often provide the missing piece in the understanding of climate patterns, both spatial and temporal, that occur across the world."[70]

Hence, "teleconnection" can be seen as a heuristically sensible term to describe both direct and indirect causal links between historical phenomena of climatic and societal change. Susanne C. Moser and Juliette A. Finzi Hart, a geographer and oceanographer who have long adopted approaches from the social sciences to study climate change, put the term "societal teleconnections" in a "simple but systematic framework"[71]: Man-made linkages add another layer of risk to the vul-

65 W. Neil Adger/ Hallie Eakin/ Alexandra Winkels, Nested and teleconnected vulnerabilities to environmental change, in: Frontiers in ecology 7/3 (2009), pp. 150–157, here p. 151.

66 Most simply they have been defined as linkages between climate anomalies at some distance from each other, see Michael H. Glantz, Currents of Change: El Nino and La Nina Impacts on Climate and Society, 2nd edition Cambridge 2001; for a detailed analysis on the example of Africa see Andreas Philipp, Zirkulationsdynamische Telekonnektivität des Sommerniederschlags im südhemisphärischen Afrika, Diss. Würzburg 2003, specially pp. 1–7 (concept), 43–44 (patterns in the northern hemisphere).

67 Henry F. Blanford, On the Connexion of the Himalaya Snowfall with Dry Winds and Seasons of Drought in India, in: Proceedings of the Royal Society of London 37 (1884), pp. 3–22; on the roots of the discussion already in the eighteenth century, see Richard H. Grove, The East India Company, the Australiens and the El Nino: Colonial Scientists and Ideas about Global Climate Change and Teleconnections between 1770 and 1930, in: Id., Ecology, Climate and Empire. The Indian Legacy in Global Environmental History 1400–1940, Delhi et al. 1998, pp. 124–146.

68 Richard W. Katz, Sir Gilbert Walker and a Connection between El Nino and Statistics, in: Statistical Science 17/1 (2002), pp. 97–112.

69 Bridgman/ Oliver 2006 (note 62), p. 9.

70 Ibid., p. 27.

71 Susanne C. Moser/ Juliette A. Finzi Hart, The long arm of climate change: societal teleconnections and the future of climate change impact studies, in: Climatic Change 129 (2015), pp. 13–26, here p. 15.

nerability to climate change, as the interactions of actors, framed by institutions, influence the *movement of material substances* (money, goods, people, biological agents) through *physical transmitter structures* (mainly transportation infrastructure) and *processes* (like commerce, travel, migration). These "societal teleconnections" are created in societal interactions and cause, reinforce, or mitigate vulnerability to climatic change. They are neither innately positive nor negative to a society, as their effects depend very much on the ability of local communities to cope with their effects. Susanne C. Moser and Juliette A. Finzi Hart list a number of societal teleconnections, which apply *cum grano salis* to **modern** as well as to *medieval* societies:

- **Economic teleconnections**: *trade of foodstuffs*
- **Energy production**: *mills, draft animals, danger of city fires*
- **Migration**: *Movement of population due to disasters or famine*
- **Human health**: *Famine and vulnerability to epidemics; effect on biological agents*

Combined with the physical meaning of teleconnection, this social enhancement of the term should be able to cover the three aspects to which a simpler impact/reaction scheme does not pay attention. Finally, from the perspective of global history, actual physical teleconnections as studied by climatologists and meteorologists might become in certain cases important heuristical tools which link similar events in regions that are otherwise not connected.[72] There are "strange parallels"[73] of historical processes in societies that are not or at least not obviously connected by trade, migration, or other forms of cultural exchange. This seems to be a fundamental difference to the extant global histories of the period 500–1500 AD, for these focus on communication and economic, cultural, and political interaction, as if these were the only possible ways to develop a global perspective on pre-modern history.[74] Climate

72 This has been stressed recently by Wolfgang Behringer, Der Planet atmet. Überlegungen zu einer Globalgeschichte der Frühen Neuzeit, in: Frühneuzeit-Info, pp. 25–55, here pp. 27–29; his argument is implicitly supported by Dieter Rothermund, Die globale Verortung der Geschichte, in: H-Soz-Kult, 09.12.2017, www.hsozkult.de/debate/id/diskussionen-4252; Nicolai Hannig, Katastrophen im 19. und 20. Jahrhundert. Befunde, Kontexte und Perspektiven, in: Neue Politische Literatur 61 (2016), pp. 439–463, here p. 461 connects the pauperism of the early 19th century as an effect to the outbreak of volcanoe Tambora.

73 Victor Lieberman, Strange Parallels: Southeast Asia in Global Context, c. 800–1830, 2 vols., Cambridge 2003–2009.

74 See Michael Borgolte, Mittelalter in der größeren Welt. Mediävistik als Globale Geschichte, in: Tillman Lohse/ Benjamin Scheller (eds.), Michael Borgolte, Mittelalter in der größeren Welt. Essays zur Geschichtsschreibung und Beiträge zur Forschung, Berlin 2014 (Europa im Mittelalter. Abhandlungen und Beiträge zur historischen Komparatistik 24), pp. 533–546; Michael Limberger/ Thomas Ertl, Vormoderne Verflechtungen von Dschingis Khan bis Christoph Columbus, in: Id./Id. (eds.), Die Welt 1250–1500 (Globalgeschichte – Die Welt 1000–2000), Wien 2009, pp. 11–28.

history is either completely missing[75] or a marginalized factor, with the possible exeption of historical disaster research.[76]

There are, however, encouraging exceptions: Patrick Boucheron's global history of the fifteenth century starts with a volcanic eruption in mid-century as a teleconnecting moment.[77] Victor Liebermann demonstrates a more long-term perspective in his two-volume comparative history of Southeast Asia by outlining the synchronicity of geophysical oscillations which resulted in meteorological extreme events. The first volume points to relatively synchronized periods of warming between 950 and 1300 and hightlights the less favorable climate in the fourteenth century. Agricultural and maritime cycles possibly both depended on climate as a third factor.[78] Liebermann refers a lot to climatic changes of solar, volcanic, and oceanic origin and describes in detail their positive impact on Burmese rice cultivation between 900 and 1300, although he does not propose a "climatic interpretation of Burmese or Eurasian history." While climatic conditions might have helped to jump start charter civilization,[79] he makes this argument with reservations.[80] In the second volume of his magistral publication, Liebermann names nine different factors that promoted similar developments in Europe and Southeast Asia, climate being just one of them, although it is considered only second in importance after commerce.[81] He basically argues that the Medieval Warm Period (800/850–1250/1300) extended the growing season in Europe and dried out arable land in Northern Europe, making it accessible, hence contributing to rapid demographic and economic growth. At the same time, higher temperatures promoted stronger monsoons in Southeast Asia, critical for rice

75 Ibid.; this applies even for the single chapters which address specific regions, for example, Michael Limberger, Vom Zeitalter der Gotik zur spätmittelalterlichen Krise. Westeuropa, in: Ibid., pp. 29–55.

76 As Behringer (note 72), p. 28, rightfully states. On the initial attempts to detect teleconnections and correlations in historical disaster research and climate history, see Gerrit Jasper Schenk, Common Grounds in Early Modern Disaster Experiences? Some Remarks on New Trends in Historical Disaster Research as Part of Environmental History and Climate History, in: Martin Knoll/ Reinhold Reith (eds.), An Environmental History of the Early Modern Period. Experiments and Perspectives (Austria: Forschung und Wissenschaft – Geschichte 10), Wien 2014, pp. 11–18, here pp. 14–15, 17; Schenk, Historical Disaster Experiences (note 43), p. 41.

77 Patrick Boucheron, Introduction. Les boucles du monde: contours du XVe siècle, in: Id. (ed.), Histoire du monde au XVe siècle, Paris 2009, pp. 9–30; Id., Kuwae ou la naissance du monde, in: L'Histoire 347 (2009), p. 8.

78 Liebermann (note 73), vol. 1, p. 49.

79 Ibid., pp. 101–112.

80 In his conclusion to the first volume, Lieberman states: "in seeking to explain the more or less coordinated 10th-14th century florescence of charter states, I have called attention to the Medieval Climate Anomaly and improved monsoon flows. But without better information, we cannot easily separate climate from autonomous changes in agricultural technique, religious organization, or foreign commerce" (Ibid., p. 459).

81 Liebermann (note 73), vol. 2, pp. 77–92.

production in interior dry zones.[82] That would be a perfect example for a physical teleconnection with clear societal consequences: Improved climate combines with other factors to increase the demographic and agrarian vitality of medieval Western Europe and Southeast Asia, from Kiev on the one side to Angkor, Pagan, and Dai Viet on the other. At the same time, the crisis that both Europe and Southeast Asia faced from the second half of the thirteenth century to the mid-fifteenth century, was not only the result of epidemics like the Black Death and land degradation (e.g. erosion and political strains) but also of the climatic downturn around 1300.[83]

The synchronicity of meteorological extreme events[84] are the common denominator of these "strange parallels" – and not so much the actual impacts or the kind of changes they caused. These might even be quite contradictory.[85] And yet, the results of dendrochronological research to reconstruct the forty wettest and driest years in Cambodia[86] are astonishing: six of the driest and wettest forty years of the last 759 years are within the fourteenth century, and the specific years are all too familiar from European climate history.[87] While some of the strange parallels in the thirteenth and fifteenth century might be attributed to volcanic activity, this does not provide an easy explanation in the fourteenth century.[88] So it is not at all surprising that we find the same years again and again here in contributions on completely different

82 Ibid., p. 80.

83 Ibid., p. 83–84.

84 As, for example, Bruce Campbell demonstrates for the remarkable year 1342. Campbell (note 15), pp. 208, 283–284.

85 See, for example, the seesaw-effects that can be found for the Mediterranean during the eleventh century, outlined in Ronnie Ellenblum, The collapse of the eastern Mediterranean. Climate change and the decline of the East, 950–1072, Cambridge 2012.

86 Brendan M. Buckley et al., Climate as a contributing factor in the demise of Angkor Cambodia. Supporting Information, in: Proceedings of the National Academy of Sciences of the United States of America 107/15 (2010), pp. 1–4, here p. 1, doi: 10.1073/pnas.0910827107.

87 The driest years: 1363, 1362, 1346, 1338, 1327, 1326; with 1362/63 well known due to a Central European drought, see Andrea Kiss's contribution. The wettest years: 1316, 1322, 1335, 1336, 1375, 1376; with 1316 and 1322 as core years of the Dantean Anomaly and the connected Great Famine, see Thomas Labbé's contribution in this volume and also Tana Li's.

88 The two wettest years on record are 1258 and 1453, with the Samalas and possibly the Kuwae eruptions, the two biggest tropical eruptions of the past millenium, as a background; on the first event see Sébastien Guillet et al., Climate response to the Samalas volcanic eruption in 1257 revealed by proxy records, in: Nature Geoscience 10 (2017), pp. 123–128 and Martin Bauch, Chronology and Impact of a Global Moment in the Thirteenth Century: The Samalas Eruption Revisited, in: Andrea Kiss/ Kathleen Pribyl (eds.), The Dance of Death in Late Medieval and Renaissance Europe. Environmental Stress, Mortality and Social Response, Abingdon-on-Thames 2019 [in print]; on the mid-fifteenth century eruptions see Martin Bauch, The Day the Sun Turned Blue. A Volcanic Eruption in the Early 1460s and its Possible Climatic Impact – a Natural Disaster Perceived Globally in the Late Middle Ages?, in: Gerrit J. Schenk (ed.), Historical Disaster Experiences. A Comparative and Transcultural Survey between Asia and Europe, Heidelberg 2017, pp. 107–138.

parts of Europe (Labbé, Brown, Camenisch, Preiser-Kapeller/ Mitsiou, Kiss et al., Vadas, Nanni, Huhtamaa) or even beyond (Li).

This volume cannot possibly fully develop the potential heuristic value of (societal) teleconnections, specifically when it comes to the new perspective on global history that it may open up. The importance of cultural factors that determine a society's specific response to meteorological extreme events and climatic oscillations, however, becomes visible if we consider the contributions on regions outside of Europe (Li) or on its margins (Preiser-Kapeller/ Mitsiou).

Beyond that, recent publications have sketched the potential contributions of climate historical studies to new contextualizations of the European Expansion.[89] Classical studies on this question, like Eric Jones' "The European Miracle,"[90] have assumed climatical conditions to be stable, with negative consequences especially for Asia,[91] while regarding Europe's climate as favorable.[92] Older theories like the Wittfogel-hypothesis seem to underlie many of Jones' assumptions,[93] but he himself admited at the time that these assumptions lacked a dense reconstruction of the frequency and severity of disasters on which to draw.[94] In the interim, researchers have contributed a great deal of such data.[95] It might be promising, therefore, to reexamine traditional topics within the historiography like the crisis of the fourteenth century or the rise of Europe to include aspects of climate history at the level of global comparisons.[96]

Most – though not all – of the papers in this volume were presented at a three-day conference in February 2016 in Rome.[97] The support of many different people and insti-

89 Bruce Campbell tried to connect the origins of the "Great Divergence" (K. Pomeranz) between Asia and Europe to the last phase of consolidation after the Great Transition. Bruce Campbell (note 15), pp. 373–394.

90 Eric Jones, The European Miracle. Environments, Economies and Geopolitics in the History of Europe and Asia, 3rd edition, Cambridge 2003.

91 "This places the explanation of the difference in Asian and European levels of breeding and income squarely in the fertility response to different risk environments" (Ibid., p. 20).

92 "Underlying the European response pattern was an adjustment to a more favorable risk profile than in the remainder of Eurasia. The options were simply a little broader." (Ibid., p. 21).

93 Especially when it comes to the dependency of European farmers on rainfall, while their Asian counterparts were busy with irrigation. (Ibid., pp. 8–9)

94 Ibid., pp. 22–29; see already Schenk, Historical Disaster Experiences (note 43), pp. 31–35.

95 See the considerable collection compiled by Chinese colleagues: De'er Zhang (ed.), A compendium of Chinese Meteorological Records of the last 3,000 years, 4 vols., Nanjing 2004; on the potential of climate history in China, see Timothy Brook, Nine Sloughs: Profiling the Climate History of the Yuan and Ming Dynasties 1260–1644, in: Journal of Chinese History 1 (2017), pp. 27–58; see also the earlier attempt: William S. Atwell, Volcanism and Short-Term Climatic Change in East Asian and World History, c. 1200–1699, in: Journal of World History 12/1 (2001), pp. 29–98.

96 Michael Mitterauer examines the agrarian system, mining, and water mills, but natural change is of no concern to him. Michael Mitterauer, Warum Europa? Mittelalterliche Grundlagen eines Sonderwegs, München 2003.

97 The Conference, entitled "The Crisis of the 14th Century: 'Teleconnections' between Environmental and Societal Change?," took place from 24–26 February 2016 at the German Historical Institue in

tutions made this event possible. Our thanks are due first to the German Historical Institute in Rome, especially to its director, Prof. Martin Baumeister, for hosting the event and supporting it financially. Additional funding came from the Max-Weber-Stiftung (Bonn) and the DFG-project "Vulnerable Societies," led by Prof. Dominik Collet (then Heidelberg University, now Oslo University). The publication of this volume was only possibly by the willingness of the Association of German-Speaking Medievalists (*Mediävistenverband*) to include it in their series *Das Mittelalter. Beihefte*. In addition, Dr. Ellen Yutzy Glebe (Kassel) edited most of the texts with great attention to linguistic style and clarity. Without the substantial financial support of the Chair of Medieval History at Darmstadt University of Technology, and the Junior Research Group "The Dantean Anomaly" (Leipzig), funded in turn by a Freigeist-Fellowship of the Volkswagen Foundation, this volume could not have been printed. Generous financial support by the Open Access Fonds of the Leibniz Association allowed us to make this volume openly available online immediately after its publication.

One of the higlights of our conference was an evening lecture delivered by Prof. Bruce M.S. Campbell (Belfast). This thought-provoking and convincing lecture – which drew on material that appeared some months later in his ground-breaking monograph on *The Great Transition* – is available online.[98] We are particularly grateful that Richard C. Hoffmann, a big fish in the still relatively small pond of Medieval Environmental History, agreed to provide this volume with a comment on the individual contributions and the methodological approach we editors have proposed above. His comment is not the only element which connects the single contributions, however. Although our decision to publish them in alphabetical order of their author's surnames may seem to suggest otherwise, this introduction has hopefully shown how the common question of "teleconnections" and the attempt to examine natural and social factors in their interactions pervades all the contributions, even if this is at times a geographical teleconnection. Forming thematical blocks would have inherently reduced their value when regarded from various perspectives:

Some of the authors here reconstruct short-term events (Brown) or processes of medium-term length (Labbé, Nanni, Huhtamaa), while other address developments over the long term (Kiss et al., Preiser-Kapeller/ Mitsiou, Li, Schreg). While such reconstructions are quite instructive and still needed, other contributions address

Rome and was organized by both editors of this volume. Two conference reports are available, both by Annabell Engel: a shorter one in English (The Crisis of the 14th Century: "Teleconnections" between Environmental and Societal Change?, 24.02.2016 – 26.02.2016 Rom, in: H-Soz-Kult, 29.09.2016, <www.hsozkult.de/conferencereport/id/tagungsberichte-6719>) and a longer one in German (Tagungsbericht "The Crisis of the 14th Century: 'Teleconnections' between Environmental and Societal Change?", Rom, 24.-26. Februar 2016, in: Mittelalter. Interdisziplinäre Forschung und Rezeptionsgeschichte, https://mittelalter.hypotheses.org/7871).

98 Bruce M.S. Campbell, The Environmental Origins of the Black Death (video lecture), https://youtu.be/7x9Oh0-viyM.

very specific written sources, in some cases for the first time in the context of environmental history. These include the Italian and Nordic calendars (Halonen) or the accounts of comital castellans in Savoy (Labbé). Other contributions critically review records long-established in climate history, like the famous Winchester pipe rolls (Schuh) and Swiss chronicles (Camenisch). If written sources are scarce, the particular value of including natural proxies in such studies is highlighted by two papers from eastern (Vadas) and northeastern Europe (Huhtamaa).

Beyond reconstruction, source criticism, and innovative and established methodologies, many of our papers elaborate on the social consequences of the extreme events in question: While in some cases cultural patterns seem to prevail over the natural impacts (Nanni, Halonen), other contributions here closely connect socio-economic effects with previous natural events (Brown, Kiss et al., Schreg). When it finally comes to the value of thinking in terms of geophysical teleconnections, however, the contributions on Byzantium (Preiser-Kapeller/ Mitsiou) and China (Li) – in addition to Bruce Campbell's video lecture – open both the large chronological perspective and also point to (not completely) coincidental developments over large distances. We sincerely hope that this volume can demonstrate the potential that research on the climate and its extremes has to provide many more insights to medievalists than just what the weather was like in the thirteenth and fourteenth centuries.

Leipzig / Darmstadt, in August 2019
Martin Bauch & Gerrit Jasper Schenk

Peter Brown

Ventus vehemens et terribilis per totam Angliam: Responses and Reactions to a Short-term Crisis in the British Isles

Abstract: Although many extreme weather events were documented throughout the medieval period, few are known in great detail due to a lack of detailed documentary and archaeological evidence. A case study with a high volume of evidence is the windstorm of 15 January 1362 which primarily affected southern and eastern England. Its effects and the responses of contemporary society in its aftermath are documented relatively widely across the British Isles, with standing building evidence supporting the written evidence at certain locations. As a result, it is possible to trace the short to medium term impact of this event including how the event was perceived, what reactions were taken across the different layers of medieval society and to what extent any preparations were made against 'the next storm'.

Keywords: windstorms, medieval England, standing buildings, repairs, religious interpretations, responses, climate, memory

Extreme windstorms have the capacity to cause severe material damage both to man-made and natural resources. In the aftermath, structures must be repaired, felled trees must be cleared and any casualties require treatment or burial. Directly affected individuals and communities face immediate hardship and longer-term difficulties while for some these events can be fortuitous; builders and roofers may see a sudden spike in business while those with sufficient financial capital may be able to take advantage of low property prices resulting from storm damage. This remains true in the present, as demonstrated by recent events such as the 15–16 October 1987 storm[1] and the winter storms of 2013/14, although the insurance and re-insurance industries have emerged to provide some level of financial security. Such events have complex consequences with multi-layered effects across society but their impact in the past, especially before c. AD 1500, has rarely been considered in detail.[2] This is mainly due to the fact that, although sudden and unusual environmental anomalies such as extreme weather events and

1 Risk Management Solutions, The Great Storm of 1987: 20–Year Retrospective. RMS Special Report, Newark 2007, pp. 14–15.

2 Some exceptions include: Christian Pfister et al., The meteorological framework of and cultural memory of three severe winter-storms in early eighteenth-century Europe, in: Climate Change 101

Peter Brown, PhD Candidate, Department of Archaeology, Durham University, South Road, Durham, DH1 3LE, UK, p.j.brown@durham.ac.uk

Open Access. © 2020 Peter Brown, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-002

other natural disasters are topics frequently described by medieval chroniclers, it is rare for single events to be described independently by a high quantity of extant written sources.[3] One such case is the extreme windstorm of 15 January (St Maur's Day) 1362 which resulted in severe damage throughout southern England, as well as Ireland and northern France. The following day, the storm proceeded onto the coasts of north-western Germany and Denmark where severe flooding is reported. These floods have become known as the 'Grote Mandrenke'; the great drowning of men,[4] and while the storm's impact in continental Europe has been the subject of previous research,[5] its impact in the British Isles has not been considered in detail beyond the histories of individual towns and buildings where damage is recorded.[6] This contribution assesses the historical and material evidence for the St Maur's Day windstorm in the British Isles, reconstructing its impact whilst seeking to identify how contemporaries perceived and responded to its occurrence. This permits an assessment of the different ways in which 14th century English society responded to a short-term environmental crisis.

The impact of the 1362 storm in Britain is primarily known through the descriptions of chroniclers. There is some difficulty assessing to what extent these descriptions are contemporaneous as while some may have been composed soon after the event, others could have been recollected or copied from existing sources decades after the storm. Although not always a good indicator of reliability, the vast majority of sources agree on the date of the storm's occurrence, its timing and direction. Most state it struck on the evening of St Maur's Day (15 January) 1361,[7] a date which

(2010), pp. 281–310; Rudolf Brázdil/ Petr Dobrovolný, History of strong winds in the Czech lands. Causes, fluctuations, impacts, in: Geographia Polonica 74 (2001), pp. 11–27.

3 Exceptions include the 1333 flood of the Arno in Florence, for which see Gerrit J. Schenk, ' ... prima ci fu la cagione de la mala provedenza de' Fiorentini ... ' Disaster and 'Life World' – Reactions in the Commune of Florence to the Flood of November 1333, in: The Medieval History Journal 10 (2006), pp. 355–386, as well as the Carinthia Earthquake of 1348, for which see Christian Rohr, Man and Natural Disaster in the Late Middle Ages. The Earthquake in Carinthia and Northern Italy on 25 January 1348 and its Perception, in: Environment and History 9 (2003), pp. 127–149.

4 Nils Hibel/ Bjørn Poulsen, The Danish Resources c. 1000–1550, Leiden 2007, pp. 47–48.

5 Maria K. Elizabeth Gottschalk, Stormvloeden en riveroverstromingen in Nederland (I de periode vóór 1400), Assen 1971, pp. 368–378; Franz Mauelshagen, Disaster and Political Culture in Germany since 1500, in: Christof Mauch/ Christian Pfister (eds.), Natural Disasters, Cultural Responses. Case Studies toward a Global Environmental History, Lanham 2009, pp. 41–75, here pp. 49–50; Hanna Hadler et al., Geoarchaeological evidence of marshland destruction in the area of Rungholt, present-day Wadden Sea around Hallig Südfall (North Frisia, Germany), by the Grote Mandrenke in 1362 AD in: Quaternary International 473 A (2018), pp. 37–54.

6 For previous work on the storm see: Charles E. Britton, A Meteorological Chronology to A.D. 1450, London 1937, p.144; Michael Hunt, The Great Storm of 15 January 1362, in: Journal of Meteorology 5 (1980), pp. 61–63; Michael Rowe, The Storm of 16th October 1987 and a brief comparison with three other historic gales in southern England (1362, 1662, 1703), in: Journal of Meteorology 13 (1988), pp. 148–155.

7 Examples include: Chronicon Abbatie de Parco Lude. The Chronicle of Louth Park Abbey, ed. Edmund Venables, Horncastle 1891, pp. 40–41; Chronica Johannis de Reading et Anonymi Cantuariensis,

is also found in a contemporary legal document which references the storm.[8] Note that this date corresponds to 15 January 1362 by modern reckoning as, during the medieval period, the new year was commonly counted from Lady Day (25 March) rather than 1 January.[9] Outliers include 'Knighton's Chronicle' which dates the storm to St Anthony's Day (17 January),[10] probably a simple lapse of memory, and the Irish 'Annals of the Four Masters' which gives the year as 1363.[11] Errors of misdating, usually to one year before or after, are very common with this category of evidence[12] and whilst the Irish source could document a different storm in the following year, further evidence demonstrating that the St Maur's Day storm certainly affected Ireland[13] suggests this is not the case. The timing of the event can be narrowed with some precision as a number of sources indicate the storm struck at evensong/vespers or around 6pm.[14] The majority of continental sources on the other hand, document the storm occurring on St Marcellus Day (16 January).[15] It therefore appears that after passing over England on the evening of 15 January, the storm arrived at the North Sea coasts of the Low Countries, Germany and Denmark early the following morning. This fits well with a chronology based on the speeds and progression of comparable modern storms such as the Great Storm of 1987, 15–16 October 1987, or the St Jude's Storm, 28 October 2013. Had these storms arrived over England at 6pm, they would have reached the German and Danish coasts around 5am the following morning.[16] Although a number of chroniclers state that the storm continued for 7 days after St Maur's Day,[17] this is almost certainly an exaggeration although the weather may have remained inclement during this period. All of the chroniclers who discuss the

1346–1367, ed. James Tait, Manchester 1914, p. 150; The Brut or The Chronicles of England. Part I, ed. Friedrich W. D. Brie, London 1906, p. 315.

8 London, The National Archives of the UK, JUST 2/18/58.

9 Christian Pfister et al., Winter Severity in Europe. The Fourteenth Century, in: Climate Change 34 (1996), pp. 91–108, here p. 96.

10 Henricus Knighton, Knighton's Chronicle 1337–1396, ed. Geoffrey H. Martin, Oxford 1995, p. 185.

11 John O'Donovan, Annals of the Four Masters, vol. 3, Dublin 1856, p. 625.

12 Pfister (note 9), p. 96.

13 Chartularies of St. Mary's Abbey, Dublin: with the register of its house at Dunbrody, and Annals of Ireland. Vol. 2, ed. John T. Gilbert, London 1884, p. 396.

14 Eulogium (Historiarum sive Temporis): Chronicon ab orbe condito usque ad annum domini M.CCC. LXVI. Vol. 3, ed. Frank S. Haydon, London 1863, p. 229; John Capgrave, The Chronicle of England, ed. Francis C. Hingeston, London 1858, p. 221; Piers Plowman. A Parallel-Text Edition of the A, B, C and Z Versions, ed. Aubrey V. C. Schmidt, Kalamazoo 2011, pp. 176–177.

15 Gottschalk (note 5), pp. 371–376; Curt Weikinn, Quellentexte zur Witterungsgeschichte Europas von der Zeitwende bis zum Jahre 1850: Hydrographie. Teil 1, Zeitwende – 1500, Berlin 1958, pp. 232–235.

16 Data from www.europeanwindstorms.org. Accessed [05/05/2016], Copyright Met Office, University of Reading and University of Exeter. Licensed under Creative Commons CC BY 4.0 International Licence: http://creativecommons.org/licenses/by/4.0/deed.en_GB.

17 Tait (note 7), p.151; Brie (note 7), p. 315.

direction also agree that the storm came from the south or southwest.[18] The evidence therefore supports the identification of the St Maur's Day event as a high-magnitude extratropical windstorm which tracked from west to east, from southwest England across to the east coast, on the night of 15 January 1362 before proceeding across to the North Sea coasts of continental Europe early the following morning.

The impact of the storm in the affected regions can be gauged through the textual descriptions. Most of the chronicles provide qualitative statements describing widespread damage to structures and the felling of trees.[19] A typical example is the 'Chronicon Angliae Petriburgense' which describes damage to houses and mills as well as the felling of individual trees in addition to large tracts of woodland.[20] In some cases, local details such as the damage received by specific, and often prominent, buildings are included such as at the Dominican Friary in Dublin,[21] the Augustinian Friary in London, the bell towers of Bury St Edmunds, Suffolk, and Norwich,[22] Norfolk, as well as the gatehouse of the Benedictine Abbey of St Albans,[23] Hertfordshire. Some chroniclers provide anecdotal accounts of local occurrences. For example, at St Augustine's Abbey in Canterbury, Kent, a chaplain was killed after seeking shelter from the storm when a roof beam of the chapel of St Pancras was blown down into the nave.[24] Similarly, in London, an Augustinian friar was reportedly blown through a window by a particularly strong gust.[25] Such incidents, together with the recorded structural damage, would correspond to a storm of force 11–12 on the Beaufort Scale. This, together with the use of terminology describing the storm as an exceptional and unprecedented occurrence[26] makes it clear that this event was well beyond what contemporaries considered 'normal' during a typical winter storm season.

Beyond written chronicles, a number of other types of document provide evidence of the damage wrought by the storm. Many of these sources, however, only date the storm to the year 1362 so it must be assumed that they deal with the 15 January

18 Adamus Murimuthensis, Adami Murimuthensis Chronica, ed. Thomas Hog, London 1846, p. 196; Tait (note 7), p. 150; Venables (note 7), p. 41.

19 For example: Polychronicon Ranulphi Higden Monachi Cetrensis, Vol, 8, ed. Joseph R. Lumby, London 1882, p. 412.

20 Chronicon Angliae Petriburgense, ed. John A. Giles, London 1845, p. 172: *Domos et molendina innumera prostravit, arbores et integras silvas in multis locis a fundamentis evulsit*.

21 See Gilbert (note 13), p. 396.

22 The Anonimalle Chronicle 1333 to 1381, ed. Vivian H. Galbraith, Manchester 1927, p. 50.

23 Gesta Abbatum Monasterii Sancti Albani, Vol. 3, A.D. 1349–1411, ed. Henry T. Riley, London 1869, p. 387.

24 William Thorne's Chronicle of Saint Augustine's Abbey Canterbury, ed. A. Hamilton Davis, Oxford 1934, p. 564.

25 Chronicon Anonymi Cantvariensis, ed. Charity Scott-Stokes/ Chris Given-Wilson, Oxford 2008, p. 119.

26 Ibid., p. 118: *inceperunt tempestates horribiles numquam alias uise uel audite et uentorum turbines in Anglia*. Martin (note 10), p. 184: *orta est horribilis et nimis ualida tempestas uentorum, qualem nunquam retroactis temporibus non creditur a plebe fuisse uisam*.

event rather than any separate storms which occurred that year. Manorial accounts such as those from Thaxted, Essex, where two windmills and a grange were heavily damaged,[27] highlight the damage faced in affected rural areas. Damage was also felt at high status residences as is demonstrated by the works required at the Royal residence of Clarendon, Wiltshire, as a result of storm damage which particularly damaged the park pale.[28] The coroner's rolls provide further evidence of casualties, describing how two parishioners were killed inside the church at Longstanton, Cambridgeshire, when a tree was blown against the church, causing masonry to fall down upon them.[29] A particularly useful source are the *Registers of the Black Prince* which cover the administration of the estates held by the heir to the throne, Prince Edward. These provide details of felled trees in the Prince's parks as well as damage to housing, mills, manors and infrastructure across his estates.[30]

Where the textual evidence describes damage at specific, named structures and these survive into the present, standing building analysis can provide further evidence of the storm's impact. A good example is Norwich Cathedral, where the Romanesque arches on the ground and first floors are superseded by a later Gothic clerestory.[31] Although later remodelling has taken place, this stylistic disjuncture (Figure 1) must be a direct result of the storm which, in blowing from the east, caused the spire to fall into the presbytery, destroying the roof and upper stories in this area, a detail corroborated by the written evidence which records severe damage to the presbytery.[32] Similarly, the gatehouse at St Albans, which was built in the aftermath of the storm on the site of an earlier gatehouse and almonry which had been heavily damaged,[33] contains structural elements which predate the current structure. Triple-roll ribs in the vaulting of one of the ground floor chambers, for example, are most likely 13th century in date. A plausible scenario, therefore, is that these fragments belonged to the earlier structures, which were destroyed or heavily damaged by the storm and later re-used in the construction of the new gatehouse.[34]

---

27 Kenneth C. Newton, Thaxted in the Fourteenth Century. An account of the manor and borough, with translated texts (Essex record office publications 33), Chelmsford 1960, pp. 71, 75.

28 London, The National Archives of the UK, E 101/460/2.

29 In this account the date of the *magna tempestas* is given as the Saturday after the feast of St Hilary (15. January 1362): London, The National Archives of the UK, JUST 2/18/58.

30 Register of Edward the Black Prince, Part IV, England, A. D. 1351–1365, ed. Michael C. B. Dawes, London 1933, pp. 416, 420, 426, 429, 431; Register of Edward the Black Prince, Part II, Duchy of Cornwall, A. D. 1351–1365, ed. Michael C. B. Dawes, London 1931, pp. 188–189.

31 Francis Woodman, The Gothic Campaigns, in: Ian Atherton et al. (ed.), Norwich Cathedral. Church, City and Diocese, 1096–1996, London, Rio Grande 1996, pp. 179, 192.

32 Henry Wharton, Anglia Sacra sive Collectio Historiarum, vol. I, London 1691, p. 415.

33 Rosalind Niblett/ Isobel Thompson, Alban's Buried Towns. An Assessment of St Albans' Archaeology up to AD 1600, Oxford 2005, p. 254.

34 Royal Commission on Historical Monuments (England) (ed.), A Guide to Saint Albans Cathedral, London 2nd ed. 1982, p. 31.

Figure 1: The presbytery of Norwich Cathedral. Although the current clerestory was remodelled in the 15th century, the disjuncture between Romanesque and gothic architecture above the first floor is a direct result of damage caused on St Maur(us)'s Day 1362. (Photograph by the author).

In some cases, however, archaeological and standing building evidence cannot substantiate the written record. At Rochester Castle, Kent, for example, although extensive repairs took place between 1367 and 1370 motivated by storm damage, the castle had been in a state of disrepair and neglect since a siege in 1264.[35] Thus, although documentary evidence does describe the damage suffered in the storm[36] and the 14th century repairs do seem to have particularly focussed on the east curtain wall and the two towers in this area,[37] disentangling in detail the damage which occurred in 1362 as opposed to existing issues of disrepair and neglect proves impossible. Similarly, at Portchester Castle, Hampshire, although extensive works were instigated on 20th January 1362, a major part of which were roofing repairs employing plumbers and tilers, this cannot be correlated with the surviving archaeological evidence.[38] Furthermore, it is important to acknowledge the significant caveats which accompany any interpretation of material evidence connected to historically documented events such as the 1362 storm. Even in cases where archaeological or standing remains appear to bear out the scenario described by written sources, other interpretations remain viable. An example comes from the historically attested fire, ignited by a lightning bolt, at the Abbey of Strata Florida, Ceredigon, Wales, in 1284.[39] Although 19th century archaeological excavations at the site uncovered melted roofing lead, a detail specifically mentioned in the historical sources documenting the blaze,[40] this cannot be definitively linked to the 1284 event as, in addition to the possibility of an undocumented fire, the historical record attests to a number of other possible fire events. As a result, while much of the damage visible in standing buildings relating to the 1362 storm seems to closely match the damage reported by contemporary sources, it should be remembered that other explanations for these phases of damage and repair remain feasible.

One building which goes unmentioned by the documentary record in connection with the St Maur's Day storm can also be linked through a combination of standing building analysis and dendrochronological evidence. St Mary's Church, Ashwell, Hertfordshire, contains a graffito at the base of the tower which mentions the storm (Figure 2). The graffito is c. 2m above ground level and would have been challenging to carve from the current floor level. This fact, taken together with

35 Reginald Allen Brown, Rochester Castle, London 1969, pp. 18–19.

36 Alfred E. Stamp, Calendar of Inquisitions Miscellaneous (Chancery), Volume III, London 1937, p. 282.

37 Allen Brown (note 36), p. 29.

38 Barry Cunliffe/ Julian Munby, Excavations at Portchester Castle, Volume IV: Medieval, the Inner Bailey, London 1985, pp. 145, 302.

39 Annales Cestrienses: or Chronicle of the Abbey of S. Werburg, at Chester, ed. Richard C. CHRISTIE, London 1887, pp. 115–117.

40 Stephen W. Williams, The Cistercian Abbey of Strata Florida: its history, and an account of the recent excavations made on its site, London 1889, pp. 153–154.

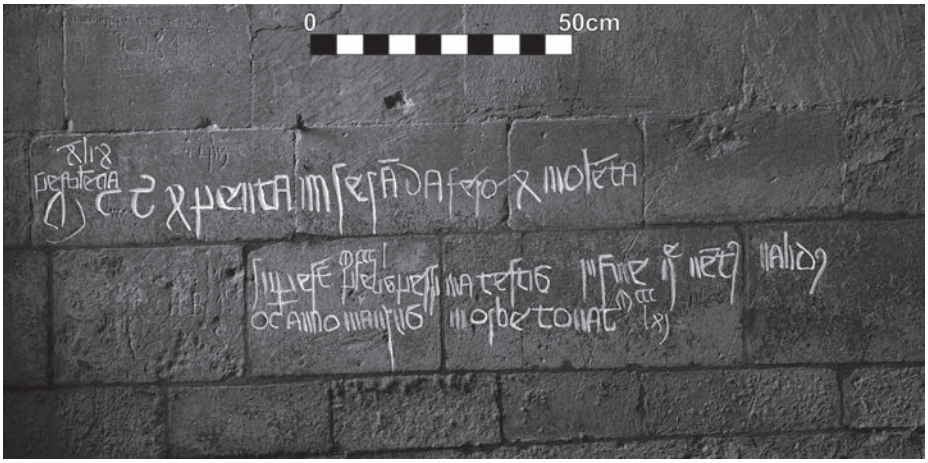

Figure 2: The graffito at the base of the tower of St Mary's Church, Ashwell, Hertfordshire. The inscription (highlighted) begins by describing the Black Death in 1350 with the last line quoting a line of popular verse which commemorates the storm of 1362 on the day of St Maur(us) (15 January). This can be translated as: "In the end, a mighty wind, Maurus, thunders in this year in the world, 1361" (Violet Pritchard, English Medieval Graffiti, Cambridge 1967, p. 182.) (Photograph by the author).

other nearby graffiti in the tower, which records wage information,[41] suggests that soon after the storm a number of masons were at work in the tower, probably with scaffolding in place. Externally, a fresh phase of construction above the first storey is visible and structural timbers from the tower have been dendrochronologically dated to 1365–1376.[42] As the chancel of the church was completed in 1368, and work on the tower continued until 1381,[43] it is possible, although unconfirmed, that the unfinished building was damaged by the St Maur's Day storm, perhaps necessitating repairs and delaying the completion of the church.

Dendrochronological dating of timbers from contemporary structures may indicate a number of additional cases of storm damage. The tower of the church of St Peter and St Mary in Stowmarket, Suffolk, for example, is constructed around an internal timber framework felled in one phase during 1362/3.[44] That this is likely to have been a repair rather than a fresh construction is indicated by a will from 1453 which describes it as "the new tower".[45] Similarly, at St Patrick's Cathedral, Dublin, only 750m from

41 Matthew Champion, Medieval Graffiti. The Lost Voices of England's Churches, London 2015, p. 209.

42 Dan Miles/ Michael Worthington/ Martin Bridge, General List. Oxford Dendrochronology Laboratory, in: Vernacular Architecture 34 (2003), pp. 109–113, here pp. 110–111.

43 Nikolaus Pevsner, The Buildings of England. Hertfordshire, London 1977, p. 74–75.

44 Robert E. Howard et al., Nottingham University Tree-Ring Dating Laboratory Results. General List, in: Vernacular Architecture 25 (1994), pp. 36–40, here p. 38.

45 Nikolaus Pevsner, The Buildings of England. Suffolk, Harmondsworth 1974, p. 443.

the documented storm damage at the Dominican Friary,[46] a timber has been dated to winter 1361/1362, the season of the storm.[47] In this case the damage itself has been interpreted as the result of a fire in the 1350s but the timber could have come from a tree felled by the storm. Another possible candidate is a low-status house from Long Wittenham, Oxfordshire, the timbers of which date to c. 1363.[48] While this close dating alone is inconclusive, documentary evidence does record damage to the local parish church of St Mary in the St Maur's Day storm[49] strengthening the possible identification of the house as a structure which either required repair or reconstruction as a result of storm damage.

Using the many different strands of evidence described above, although not all known cases are discussed, it is possible to plot the known points where damage was felt on the night of 15 January 1362. This is presented below (Figure 3, 1) and shows both a confidence rating, certain (red), high confidence (orange) and low confidence (yellow). 'Certain' locations are those where documentary evidence specifically describes damage on 15 January 1362 while those in the 'high confidence' category are locations where storm damage is reported in 1362, with the exact date of the storm not given. At those locations in the 'low confidence' category are the uncertain locations identified based on close dendrochronological dating, discussed above, and sites where storm damage, and often corresponding repairs, are documented in the immediate aftermath of the 1362 event but no explicit link is made in the sources to the St Maur's Day storm itself. In addition, the type of evidence presented (historical, structural, documentary or a combination) is shown in (Figure 3, 2). Although the available evidence does not permit many sites to be definitively attributed to the St Maur's Day storm, the evidence certainly attests to extensive damage throughout eastern England. According to a kernel density plot of these data (Figure 3, 3), London and its surroundings register as the epicentre of the damage and indeed urban areas must have focussed the damage with their higher densities of population and structures. It must be remembered however, that only the density of known, documented damage rather than the density of the total damage which occurred is mapped and damage was more likely to be recorded in areas of high population. This may explain why there is no known data from south Wales and little evidence from Cornwall and Devon although the storm almost certainly affected these areas. The known area of effect, and particularly the areas where damage certainly occurred, on the other hand, covered some of England's most populous counties (Figure 3, 4), especially

46 See Gilbert (note 13), p. 396.

47 David M. Brown, Irish and English Dendrochronology, in: Vernacular Architecture 41 (2010), pp. 119–122, here p. 120.

48 Nat W. Alcock, et al., Leverhulme Cruck Project. Results 1988, in: Vernacular Architecture 20 (1989), pp. 43–45, here pp. 43–44.

49 RCHM (Royal Commission on Historical Manuscripts), Second Report of the Royal Commission on Historical Manuscripts, London 1874, p. 128.

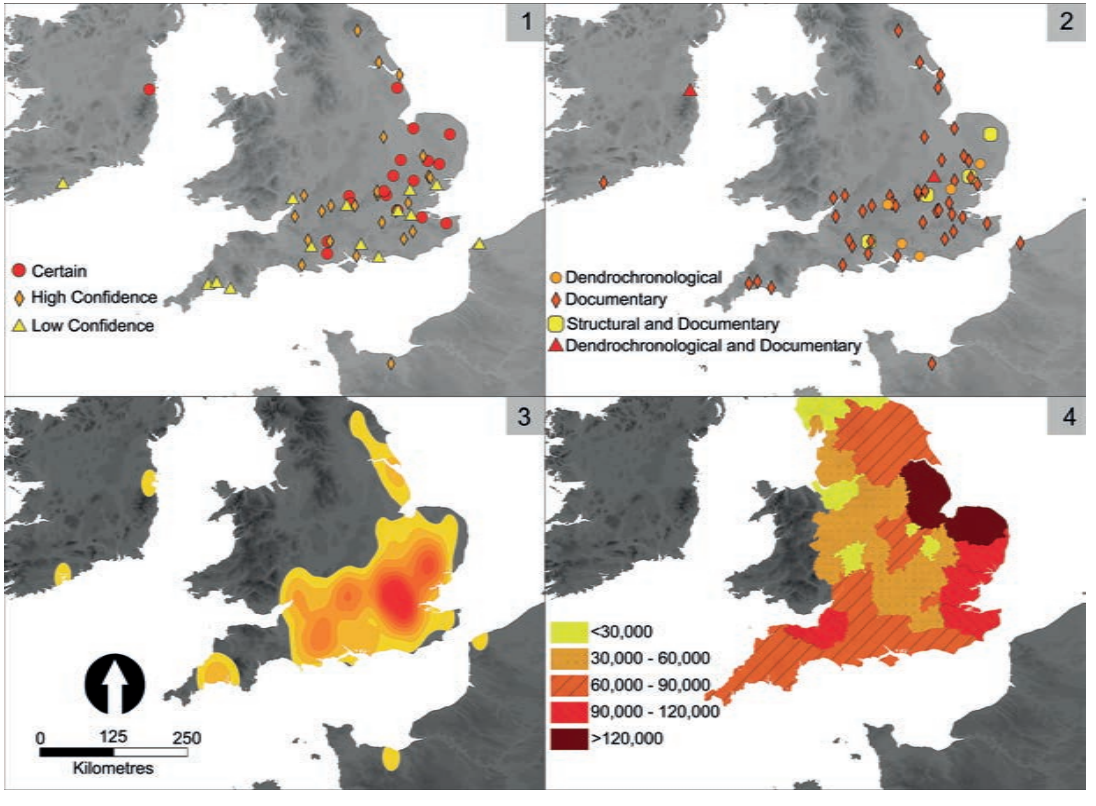

Figure 3: Four maps of the impact of the 1362 St Maur(us) windstorm in the British Isles. Clockwise from top left: (1) Confidence rating of data. (2) Different data types. (3) Kernel density plot of known damage created in ArcGIS 10.4. (4) Contemporary spread of the English population at the county level as derived from the poll tax return of 1377 (Stephen Broadberry et al., British Economic Growth 1270–1870, Cambridge 2015, pp. 25–26), only 15 years after the storm. (Created by the author).

Norfolk, Suffolk, Essex and Kent. Taken together the evidence agrees well with the view derived solely from the written evidence; that the storm originated from the south west and particularly severely affected the south east.

Despite the quantity and different types of source material, it is clear that the available evidence provides only a biased view of what occurred in the St Maur's Day storm. This is a result of the limited extent to which damage and repairs were recorded in addition to the survival of evidence, both written and structural, into the present. Ecclesiastical and seigneurial properties and interests are well represented while the immediate impact of the event on the lower classes, who were more likely to be illiterate and had less need to record expenses, is covered comparatively rarely. Although many of the sources describe trees being felled, there is no way to quantify or gauge the affected geographic extent. As a comparison, some 15 million trees were felled during the Great Storm of 1987[50] and although this number may have been elevated due to modern planting regimes and the fact that leaves were still on the trees,[51] a number in the same range must also have been felled in 1362. Relatively few areas where trees were felled, however, can be positively identified.[52] Another area for which there is conspicuously limited evidence is the storm's effect on shipping. The only known affected vessel, the *Tarrit*, was forced to shore at Plymouth by the storm and subsequently became the subject of a legal dispute after being plundered by the locals.[53] However, the case of the *Tarrit* cannot have been an isolated incident as, although no further specific cases are known in detail, one source does record that many other vessels were lost.[54] As a result of the various gaps in the available evidence, what can be said about the storm's impact on the lower classes, woodland in undocumented areas and shipping is limited and conjectural.

The most comprehensive previous assessment of the St Maur's Day storm compared it to the windstorms of 1662, 1703 and 1987.[55] These were similar in that they

50 Allen JRL (1992) Trees and their Response to Wind: Mid Flandrian Strong Winds, Severn Estuary and Inner Bristol Channel, Southwest Britain, in: Philosophical Transactions of the Royal Society B 338 (1286), pp. 335–364, here p. 340.

51 Petr Dobrovolný/ Rudolf Brázdil, Documentary evidence on strong winds related to convective storms in the Czech Republic since AD 1500, in: Atmospheric Research 67/68 (2003), pp. 95–116, here p. 107; Chris P. Quine, Damage to trees and woodlands in the storm of 15–16 October 1987, in: Weather 43 (1988), pp. 114–118, here p. 115.

52 Exceptions include Alveston, Warwickshire, see Worcester, Worcester Cathedral Library, E20, and possibly Watlington, Oxfordshire, see K S. B. Keats-Rohan, 'Most Securely Fortified': Wallingford Castle 1071–1540, in: K. S. B. Keats-Rohan/ Neil Christie/ David Roffe (eds.), Wallingford: The Castle and the Town in Context, Oxford 2015, pp. 34–115, here p. 94.

53 Rymer's Foedera, Volume I, 1066–1377, ed. Thomas D. Hardy, London 1869, p. 420; London, The National Archives of the UK, SC 8/247/12320.

54 O'Donovan (note 11), p. 625: *A very great storm in this year threw down several churches and houses, and also sank many ships and boats*.

55 Rowe (note 6), pp. 148–155.

were high magnitude events which tracked across southern England from west to east. As an analogy, the peak wind speed recorded during the 1987 storm was 196 km/h. Although not unusual for the British Isles as a whole, south-east of an imaginary line between Norwich and Southampton, such wind speeds have an estimated recurrence interval of over 200 years.[56] On average, this means that in this region, a storm of this magnitude sits well beyond living memory. As all the evidence indicates the St Maur's Day storm was a comparable phenomenon to the Great Storm of 1987, the long recurrence interval fits well with the chronicler's descriptions of the storm as the worst that could be recalled.

Just how unusual the St Maur's Day storm was can be further assessed through an analysis of the climatic and meteorological conditions prior to its occurrence. This can be reconstructed in very vague terms from information relating to the weather over the preceding months. Historical evidence from the second half of 1361 shows that, following a summer of drought in England,[57] sea ice was present in Iceland during the autumn[58] and by Christmas time fruit trees were in bloom near Paris.[59] The presence of sea ice suggests cold conditions in the Arctic while flowering trees indicate an unusually warm winter in northern France. This patchy and uncertain picture can be augmented with the addition of climatic proxy evidence for the early 1360s. These indicate a low-level spike in sea surface temperatures during the early 1360s which was sharply followed by cooling[60] and a peak in sea ice coverage in 1364.[61] Reconstructed summer temperatures across Europe signal high fluctuations between 1361 and 1362,[62] with anomalously cold summers in Slovakia during both years[63] and

56 Stephen D. Burt/ D. A. Mansfield, The Great Storm of 15–16 October 1987, in: Weather 43 (1988), pp. 90–110, here pp. 101–103.

57 Peter F. Brandon, Late-Medieval Weather in Sussex and Its Agricultural Significance, in: Transactions of the Institute of British Geographers 54 (1971), pp. 1–17, here p. 3; Astrid Ogilvie/ Graham Farmer, Documenting the Medieval Climate, in: Mike Hulme/ Elaine Barrow (eds.), Climates of the British Isles. present, past and future, London, New York 1997, pp. 112–133, here p. 127.

58 Islandske Annaler indtil 1578, ed. Gustav Storm, Christiana 1888, p. 359.

59 Jeane de Venette, The Chronicle of Jean de Venette, ed. Jean Birdshall/ Richard A. Newhall, New York 1953, p. 108.

60 Alastair G. Dawson et al., Greenland (GISP2) ice core and historical indicators of complex North Atlantic climate changes during the fourteenth century, in: The Holocene 17 (2007), pp. 427–434, here p. 431.

61 Guillaume Massé et al., Abrupt climate changes for Iceland during the last millennium. Evidence from high resolution sea ice reconstructions, in: Earth and Planetary Science Letters 269 (2008), pp. 565–569, here p. 567.

62 Jürg Luterbacher et al., European summer temperatures since Roman times, in: Environmental Research Letters 11 (2016), pp. 1–12.

63 Ulf Büntgen et al., Filling the Eastern European gap in millennium-long temperature reconstructions, in: Proceedings of the National Academy of Sciences 110 (2013), Online Data available at: http://www.ncdc.noaa.gov/paleo/treering.html [Accessed 31/08/2016].

a 'great' drought in Croatia in spring 1362.[64] Meanwhile the phase of the North Atlantic Oscillation appears to have favoured higher magnitude storms at this time.[65] These proxies provide quantitative proof of the dramatic fluctuations in global atmospheric circulation which characterized the period from the late 13th century through to the end of the 14th century, with the late 1350s and early 1360s registering as one of the peaks of environmental instability between 1300 and 1500.[66] It is important to emphasise though, that there are great difficulties in attributing single events to climatic change, with windstorms a particularly uncertain phenomenon.[67] That being the case, the storm of January 1362 demonstrably occurred during a period of high climatic instability when the North Atlantic Oscillation favoured storms of increased magnitude. While it is difficult to make any unqualified statements, it is likely that the global climatic shifts in play at this time affected the magnitude and track taken by the storm.

Just as severe fluctuations were affecting atmospheric circulation, and perhaps as a 'teleconnection' between environment and society, unprecedented anomalies were also occurring in the world of man. Only a decade before the storm, the Black Death had reduced the population of England by approximately 40 percent.[68] This plague, understandably provoked great fear, not only as a result of the high mortality but also due to the unsettling thought that, as a sign of divine displeasure, worse could follow. Plague flared up once more in 1361, its first major resurgence since the Black Death, and against this troubling backdrop the occurrence of a windstorm of a magnitude beyond which nobody living could recall must have provoked heightened fear and alarm. The two 'pestilences', wind and disease, were listed together in a petition to parliament in October 1362[69] and some of the chronicler's accounts illustrate the popular mindset. The 'Eulogium Historiarum', for example, describes how some contemporaries believed the storm to be a divine punishment[70] while, similarly, an anonymous chronicler from Canterbury commented on the anxiety it caused amongst the

64 Andrea Kiss/ Zrinka Nikolić, Droughts, Dry Spells and Low Water Levels in Medieval Hungary (and Croatia) I. The Great Droughts of 1362, 1474, 1479, 1494 and 1507, in: Journal of Environmental Geography 8 (2015), pp. 11–22, here pp. 13–14.

65 Valérie Trouet et al., North Atlantic storminess and Atlantic Meridional Overturning Circulation during the last Millennium. Reconciling contradictory proxy records of NAO variability, in: Global and Planetary Change 84/85 (2012), pp. 48–55, here p. 53.

66 Bruce M. S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval World, Cambridge 2016, p. 339.

67 National Academies of Sciences, Engineering, and Medicine, Attribution of Extreme Weather Events in the Context of Climate Change, Washington 2016, pp. 111–114.

68 Broadberry (note 49), p. 14.

69 Mark Ormrod, The Parliament Rolls of medieval England, 1275–1504, vol. 5 Edward III, 1351–1377, Woodbridge 2005, p. 142.

70 Haydon (note 14), p. 229: *unde creditur a nonnullis diram Dei fuisse flagellationem*.

English population.[71] During the medieval period, storms were widely believed to be demonic in origin with frightening folk stories often attached to their occurrences.[72] This is hinted at by one chronicler who blamed the fact that a joust had been scheduled to take place two days later as the root cause of the storm.[73] Although the Church had lifted its ban on jousting in 1316,[74] evidently some churchmen still regarded them as events which displeased God. Each of the participants in this particular event seem to have provocatively embraced this view by outfitting themselves as one of the seven deadly sins.[75] So perturbed was the anonymous Canterbury chronicler that he even went so far as to compare the storm to the Day of Judgment, a well-known event for Christians through Church teachings and popular culture. For example, the fifteen signs of doom associated with the apocalypse, included in popular poetry such as the early 14th century work 'The Pricke of Concience', contained many elements which contemporaries could see around them, the coming of natural disasters, the destruction of buildings and high mortality of men.[76] We can even surmise that the foreboding miracles reported throughout 1361, including a solar eclipse, blood red rain and the appearance of a cross of blood in the air,[77] may have compounded the situation as such occurrences were frequently interpreted as ominous portents of the future.[78]

The Church appears to have capitalized on the state of fear among the populace through a variety of means. For example, although it is unknown whether the storm was the cause of damage to the belfry at the Augustinian friary of Clare, Suffolk, uncertainty for what awaited in the afterlife may explain why, in 1363, the son of a local alderman donated £100 towards the construction of a new bell-tower. This case reveals a motivation for such charitable acts, as the great generosity of the donation led to the appointment of a priest to hold prayers for the souls, both in life and death, of the benefactor, his parents and any others to which he was obligated.[79] Such prayers were believed to ease the passage of the individual and his family members from the troubled temporal realm into the kingdom of heaven. In the storm's aftermath charitable donations of wind-felled timber were also made by the Black Prince

71 Scott-Stokes/ Given-Wilson (note 25), p. 118–119: *... et inhabitantes terram Anglie timor ac tremor sic exterruit quod nullus sciuit ubi secure potuit laticare, nam ecclesiarum campanilia, molendina ad uentum ac mansiones multe ceciderunt ad terram absque magna corporum lesione.*

72 Carl S. Watkins, History and the Supernatural in Medieval England, Cambridge 2007, pp. 58–59.

73 Scott-Stokes/ Given-Wilson (note 25), p. 118–119.

74 Juliet R. V. Barker, The Tournament in England 1100–1400, Woodbridge. 1986, pp. 70–83, 95. James W. Brodman, Charity and Religion in Medieval Europe, Washington D. C. 2009, pp. 35–37.

75 Tait (note 7), p. 151.

76 The Prick of Conscience (Stimulus Conscientiae), ed. Richard Morris, Berlin 1863, pp. 129–131.

77 Hog (note 18), p. 196; Lumby (note 19), p. 411.

78 Watkins (note 72), pp. 47–48.

79 The Cartulary of the Augustinian Friars of Clare, ed. Christopher Harper-Bill, Woodbridge 1991, p. 85.

to ecclesiastical institutions, such as the Dominican Friars of Dunstable[80] and the parish church of Great Heney,[81] Essex, but also to his lay tenants whose homes had been damaged, such as those at Torpel, Northamptonshire.[82] Charity of this kind may have been believed to offer remission for sins[83] but, more cynically, it also served the practical purpose of speeding the recovery of the Prince's tenants allowing them to resume rental payments as quickly as possible. Certainly, this was true of those outstanding debts overlooked by the exchequer in the aftermath of the storm.[84] Although the importance of charity was an integral part of the Christian worldview, financial practicalities meant that it was in the interests of landowners that their tenants were not pushed to a 'tipping point' by crises such as the storm.

For those without the resources to make sizeable charitable donations, similar spiritual benefits could be obtained through indulgencies. These amounted to reductions in the amount of time an individual's soul spent in purgatory and were offered in exchange for donations of money or labour, or to attract pilgrims, at a number of the structures damaged on St Maur's Day. Thus at Norwich Cathedral in 1363, an indulgence of 7 years and 280 days was granted to those who contributed towards the repairs made necessary by storm damage.[85] Lesser indulgences were also advertised at a number of other ecclesiastical institutions due to storm damage such as Cloyne Cathedral, County Cork,[86] the Benedictine Abbey of St John, Colchester, Essex[87] and the churches of Stone, Kent[88] and Whitechapel, London.[89] These measures presumably helped the affected Church properties to finance the required repairs although precisely how effective they were is unknown.

The fear and panic evident in the descriptions of the chroniclers and the theological dimensions associated with some reactions to the storm certainly do not explain the responses of all groups. Some directly benefitted from the widespread damage while others pragmatically turned the situation to their own advantage. Roofers and

80 Register of Edward the Black Prince, Part IV, England, A. D. 1351–1365, ed. Michael C. B. Dawes, London 1933, p. 417.
81 Ibid., p. 432.
82 Ibid., p. 431.
83 James W. Brodman, Charity and Religion in Medieval Europe, Washington D. C. 2009, pp. 35–37.
84 W. Mark Ormrod, The Politics of Pestilence. Government in England after the Black Death, in: W. Mark Ormrod/ Phillip G. Lindley (eds.), The Black Death in England, Stamford 1996, pp. 147–181, here p. 169.
85 Calendar of entries in the Papal Registers relating to Great Britain and Ireland. Petitions to the Pope, Volume I, ed. William H. Bliss, London 1896, p. 418: "For an indulgence, during ten years, of seven years and seven quadragene to penitents who help to repair the cathedral church of Holy Trinity, Norwich, which has suffered from wind and storm."
86 Ibid., p. 414.
87 Ibid., p. 444.
88 Ibid., pp. 421–422.
89 Ibid., p. 468.

tilers, for instance, were in a strong position on the morning after the storm. The high demand for their services is demonstrated not only by the numerous reports of damaged buildings but also by the fact that in the storm's aftermath 123,500 tiles were purchased from one Roger 'tiler' at King's Langley, Hertfordshire, at a price of 5s 6d per thousand.[90] That some may have been tempted to exploit the sudden rise in demand is suggested by a royal decree which forbade tilers and roofers from raising the prices of their tiles or labour beyond what had been charged at Christmas 1361/1362. This accords with the concept of the just price championed by churchmen such as Aquinas who argued that "if … one man [may] derive a great advantage by becoming possessed of the other man's property, and the seller be not at a loss through being without that thing, the latter ought not to raise the price".[91] The legislation also mirrored price fixing that had been enacted in England in the face of the Black Death[92] and the fact it was issued to the sheriffs throughout England illustrates that the storm was perceived to be a universal hazard.[93] The proclamation can be traced through the English administrative bureaucracy as it was reissued by the abbot of St Albans to the townspeople there[94] while the abbot of Peterborough wrote back to the Chancery to guarantee that the order was not being contravened within the lands administered by the abbey.[95] Profiteering from the situation can also be seen in the actions of Simon Islip, Archbishop of Canterbury. After the storm, Islip purchased land in Oxford in order to found a new University college to be called 'Canterbury Hall'. The source which describes this purchase strongly implies that the land was available because the buildings which had previously stood there had been damaged in the storm.[96] This case probably represents a fairly common occurrence in the years which followed in which those with reserves of financial capital were able to cheaply acquire property from those too poor to fund repairs themselves. Although contemporary moral thinking condemned making a profit from natural disasters, this did not prevent the Archbishop of Canterbury, England's foremost prelate, from turning the situation to the advantage of the Church.

In the weeks and months that followed, landowners such as the Black Prince were also determined to maximise profits in order to mitigate any financial losses.

---

90 A History of Hertfordshire: Volume IV, ed. William Page, London 1914, p. 265.

91 Thomas Aquinas, Summa Theologica, Volume Two, Containing Second Part of the Second Part, QQ. 1–189 *and Third Part, QQ. 1–90*, New York et al. 1947, pp.1513–1514.

92 Robert Braid, Economic Behaviour, Markets and Crises. The English Economy in the Wake of Plague and Famine in the 14th Century, in: Simonetta Cavaciocchi (ed.), Le interazioni fra economia e ambiente biologico nell'Europa preindustriale secc. XIII-XVIII, Firenze 2010, pp. 335–372, here p. 359.

93 Calendar of the Close Rolls, Edward III, Volume XI, 1360–1364, ed. Henry C. Maxwell Lyte, London 1909, p. 238.

94 Riley (note 23), pp. 46–47.

95 Stamp (note 37), p. 177.

96 Wharton (note 33), p. 46.

This can be seen across the Prince's estates where profit-making and loss-minimizing activities were instigated such as selling off hay and wind-felled timber and putting a lime-kiln into operation to produce lime for resale in order to generate income.[97] Concern to mitigate the negative economic effects of the storm are further demonstrated by the fact that the Prince felt the need to re-negotiate a long-held custom that the parker, the administrator who oversaw the management of the park, at his estate of Berkhamsted, Hertfordshire, was entitled to the profits from the sale of any wind-felled timber on the estate. Instead, as a result of the unprecedented number of trees felled in 1362, the Prince offered a fixed annual sum of 100 shillings, amounting to a guaranteed but reduced rate compared to average earnings in previous years.[98] The management of the prince's estates was clearly relatively efficient and responsive to sudden shocks, standing in stark contrast to the foreboding and superstitious interpretations advanced by many of the chroniclers who documented the storm.

Such practicality is also evident in the decisions taken in the repairs to the structures themselves which were damaged on St Maur's Day. At Salisbury Cathedral, for example, the storm damaged both the uppermost c. 9m of the spire as well as the freestanding belfry. As the belfry was demolished in the late 18th century it is impossible to analyse the impact of the storm in this structure but the spire is extant and the repair pattern is observable. Perhaps most interestingly, dendrochronological analysis of the timbers in the spire's internal scaffold return felling dates between 1344–1376, at least a generation after the construction of the spire. The scaffold has therefore been interpreted as an insertion necessitated by storm damage in 1362,[99] which is attested by the documentary record.[100] Although this scaffold may have facilitated the repairs required to the spire, a possible interpretation is that it was intended to offer structural reinforcement against any future storm winds. This possibility is given credence by both the location of the scaffold, internal rather than external, as well as the choice of material, oak rather than lighter alder or pine more commonly used in temporary scaffolding.[101] A parallel comes from the documentary account of the rebuilding of the gatehouse at St Albans after the storm in which it is emphasised that the new gatehouse was covered in a strong lead roof.[102] As a sturdy roofing material, this may have been believed to offer improved protection against any similar future event. A comparable instance of the response of monastic landowners in the immediate aftermath of an environmental shock comes from the lands of Canterbury

97 Dawes (note 80), pp. 420, 429, 431.
98 Ibid., p. 464.
99 Dan W. H. Miles et al., The tree-ring dating of the tower and spire at Salisbury Cathedral, Wiltshire, London 2004, pp. 20–22.
100 Bliss (note 85), pp. 462–463; Calendar of entries in the Papal Registers relating to Great Britain and Ireland. Papal Letters, Volume IV, ed. William H. Bliss, London 1902, p. 89.
101 Miles (note 99), p. 22.
102 Riley (note 23), p. 387: *et fortissimum tectum ipsius cum plumbo cooperuit*.

Cathedral Priory, where following the storm surge floods of 1287/88 high investment focussed on erecting dykes to protect land against future floods.[103] Perhaps as in this case, investment in available protection, a reinforced spire and more durable roofing, was the favoured way to protect against any future high winds. The difference in scale of the response likely owes both to the relative helplessness of humanity against storms compared to floods, as well as the long recurrence interval of the wind speeds experienced on St Maur's Day, which were without precedent, compared to North Sea storm surge tides, which occurred relatively regularly throughout this period.[104] There is no known evidence for comparable actions taken by lay landowners or amongst the peasant classes in the aftermath of January 1362, who were less likely to possess the required financial reserves, but given the paucity of both documentary and structural evidence, an absence of evidence certainly does not rule out the possibility that such measures may have been taken.

A number of lines of evidence demonstrate that in the years that followed the storm, its occurrence was not forgotten. Later manuscripts frequently contained short marginal notes or other references to the St Maur's Day storm[105] while a number of chroniclers writing soon afterwards recorded popular verses commemorating the event.[106] That these verses were widely known across the area of effect is demonstrated by the graffito from St Mary's Church, Ashwell, (Figure 2) which closely matches a verse given by a contemporary chronicler.[107] As discussed above, the available evidence suggests this graffito is likely to have been carved by a mason working in the tower. If this is the case, the verse was clearly known by both churchmen and laymen providing proof of its wide audience. Although there is no written evidence to substantiate it, another way in which the storm must have been commemorated was through the marks of damage and repair seen on many major ecclesiastical structures, as well as more humble buildings, throughout southern England. These damage patterns must have remained visible long after 1362 as many of the structures which had been damaged by the storm went unrepaired for long periods due to the scarcity of

103 Anthony Gross/ Andrew Butcher, Adaptation and Investment in the Age of the Great Storms. Agricultural Policy on the Manors of the Principal Lords of the Romney Marshes and the Marshland Fringe, in: Jill Eddison (ed.), Romney Marsh. The Debatable Ground, Oxford 1991, pp. 107–117, here pp. 108–110.

104 M. Bailey, Per impetum maris. natural disaster and economic decline in eastern England, 1275–1350, in: Bruce M. S. Campbell (ed.), Before the Black Death. Studies in the 'crisis' of the early fourteenth century, Manchester, New York 1991, pp. 184–208.

105 See for example: Durham, Durham University Library, MS Cosin V/III/19/R fol. 19r; San Marino, Huntington Library, HM/28174 fol. 143v; Elizabeth Solopova, Manuscripts of the Wycliffe Bible in the Bodleian and Oxford College Libraries, Liverpool 2016, p. 211.

106 Hog (note 18), p. 196; Annales Monastici, Volume III, ed. Henry R. Luard, London 1866, p. 477; Hingeston (note 14), p. 221.

107 Hog (note 18), p. 196; Luard (note 106), p. 477: *Ecce flat hoc anno Maurus, in orbe tonat*. The underlined segment of the quote is exactly what was engraved in the tower at St Mary's Church, Ashwell.

available labour,[108] an enduring legacy of the Black Death and the renewed spread of plague in 1361. As a result, the visible damage must have served as active reminders of the storm's occurrence. The 1356 earthquake in Basel, Switzerland, provides a useful analogy as Basel's inhabitants could still point out the damage and repairs caused by the earthquake into the 16th century.[109] Similarly, damage following the 1362 storm, particularly in the case of large structures such as Norwich Cathedral, was both highly visible and required repairs that would have taken many years to complete. It seems almost certain therefore, that just as in Basel, the affected communities would have commemorated and remembered the storm which had necessitated the costly and lengthy repairs.

This contribution has sought to consider the evidence for the storm of St Maur's Day 1362. The various types of data discussed above, including both documentary and structural evidence, permit a particularly detailed reconstruction of an extreme storm from a pre-instrumental period. Beyond its identification as a severe storm which tracked across southern England, it is clear that this windstorm was an anomalous event beyond what would usually be expected during a normal winter storm season. This accords well with the ever-higher resolution climatic data attesting to the climatic variability which characterized this period, both as a whole and the decade of the storm in particular. In addition, the written evidence indicates that the storm was unprecedented in living memory and thus its occurrence provoked fear and alarm amongst certain sectors of society. This must have been particularly compounded by the recent memory of the Black Death and the resurgence of plague in the preceding year. The storm's cultural impact can be demonstrated by the popular verses recorded by chroniclers and the fact that one of these was inscribed at the church of St Mary's, Ashwell. Despite the immediate fear and alarm, however, in many respects pragmatic responses were adopted across the various strata of medieval society. Authorities were able to ease pressure on affected groups through legislation; fixing the prices of key commodities (roof tiles and labour) and overlooking debt repayments. At least in the case of the Black Prince, the storm's financial impact was managed through profit-making enterprises and careful management of the wind-felled timber. In the few cases where sufficient evidence survives, the repairs and reconstruction that came in the storm's wake may have aimed to reduce the risk of damage from a similar event in the future. From a modern-day perspective, although many of the contemporary descriptions of the St Maur's Day storm were heavily coloured by the medieval Christian worldview, sometimes emphasising superstitious interpretations, the various material ways in which society responded were, perhaps surprisingly, usually pragmatic, opportunistic and forward-thinking.

108 Scott-Stokes/ Given-Wilson (note 25), pp. 118–119: ... *mansionesque et edificia per dictum uentum sic diruta pro defectu operariorum irreperata deformiter remanserunt*.

109 Richard C. Hoffmann, An Environmental History of Medieval Europe, Cambridge 2014, p. 307.

Chantal Camenisch

The Potential of Late Medieval and Early Modern Narrative Sources from the Area of Modern Switzerland for the Climate History of the Fourteenth Century

Abstract: The fourteenth century is known to have witnessed several significant environmental and climatological events. This paper analyses Swiss narrative sources to appraise their potential for further study of medieval historical climatology. It examines a number of sources – dating to the fourteenth, fifteenth, and sixteenth centuries – and their references to these fourteenth-century events.

These sources mention major historical events including the Great Famine of 1315 to 1322, the Black Death, floods, and an extremely cold winter. Although they describe some extreme weather events at length, not all of the texts examined mention all the major events, and there are errors in the dating, as well. Such sources do not regularly refer to the weather in general. A reconstruction of the climate in the area of modern Switzerland relying solely on these historical documents is therefore impossible, but they do provide valuable information on various aspects of fourteenth-century environmental and climate history, especially when correlated with other types of climate reconstructions.

Keywords: historical climatology, famine, epidemic disease, narrative sources, 14th century

1 Introduction

In Europe, the fourteenth century was a period of transition in many ways: modern historical research generally acknowledges how disruptions in social structures and economic fluctuations played a role in the late medieval crisis, but scholars also point to the nascent rise of European prosperity during this period.[1] Not all social classes ben-

1 See, Bruce M. S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval World, Cambridge 2016, pp. 1–2; Peter Schuster, Die Krise des Spätmittelalters. Zur Evidenz eines sozial- und wirtschaftsgeschichtlichen Paradigmas in der Geschichtsschreibung des 20. Jahrhunderts, in: Historische Zeitschrift 269 (1999), pp. 19–55; Gerrit Jasper Schenk, Die Zeit Karls VI. zwischen

Dr. Chantal Camenisch, Universität Bern, Historisches Institut, Unitobler, Länggassstrasse 49, CH-3012 Bern, chantal.camenisch@hist.unibe.ch

Open Access. © 2020 Chantal Camenisch, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-003

efited from the growing prosperity; many remained vulnerable to crisis.[2] During the fourteenth century, European societies had to cope with numerous challenges – the Hundred Years War, for example, and the struggle for power in the Holy Roman Empire between vying dynasties, as well as between the Emperor, the electors, and the emerging towns.[3] Peasants revolted repeatedly – most notably in the *Jacquerie* in northern France in 1358 and the English Peasants' Revolt in 1381.[4] At the same time, the Catholic Church was dealing with a series of crisis of its own – the relocation of the papal residence to Avignon in 1309, the Western Schism after 1378, and heretic movements, such as the Apostles in Lombardy or the Lollards in England.[5] The most severe calamities of all – even apocalyptic in the eyes of contemporaries – were the demographic declines caused by famines from 1315 to 1322 and by the Black Death in the years 1347 to 1351.[6]

The fourteenth century also represents a critical moment in climate history, for many scholars date the onset of the Little Ice Age to the beginning of this period.[7] Over the course of the 1300s, a number of notable climate and weather anomalies occurred, which also affected the area of modern Switzerland. Some of these anomalies significantly impacted human society: the famines from 1315 to 1322, for instance, were a consequence of weather-induced harvest failures. Bruce Campbell has convincingly outlined remarkable links between climate and the plague in the middle of the fourteenth century.[8] Therefore, accounts of the plague in Switzerland are also included into this source sample, although they are not actually weather descriptions per se.

For the area of modern Switzerland, a number of available climate reconstructions based on proxies from natural archives include data on the fourteenth century. Among

---

Frost und Blüte. Katastrophen, Krisen und Klimawandel im 14. Jahrhundert, in: Jiří Fajt und Markus Hörsch (eds.), Kaiser Karl IV. 1316–2016. Erste Bayerisch-Tschechische Landesausstellung. Ausstellungskatalog, Prague 2016, pp. 31–39; Jacques Le Goff, L'Europe est-elle née au Moyen Age?, Paris 2003, p. 205.

2 E.g., Christian Pfister/ Rudolf Brázdil, Climatic Variability in the Sixteenth-Century Europe and its Social Dimension. A Synthesis, in: Christian Pfister/ Rudolf Brázdil/ Rüdiger Glaser (eds.), Climatic Variability in Sixteenth-Century Europe and Its Social Dimension, Dordrecht, Norwell 1999, pp. 5–53, reprint of Climatic Change, Special Issue, 43/1 (1999), pp. 5–53.

3 Ulf Dirlmeier/ Gerhard Fouquet/ Bernd Fuhrmann, Europa im Spätmittelalter, 1215–1378 (Oldenbourg Grundriss der Geschichte 8), Munich 2003, pp. 100–109.

4 See Robert Fossier, The great trial, in: Id. (ed.), The Cambridge Illustrated History of the Middle Ages III, 1250–1520, Cambridge, New York, Melbourne 1997, pp. 87–90.

5 Le Goff (note 1), pp. 224–229; Jacques Verger, Different values and authorities, in: Robert Fossier (ed.), The Cambridge Illustrated History of the Middle Ages III, 1250–1520, Cambridge, New York, Melbourne 1997, pp. 123–146.

6 Bruce M. S. Campbell, The European Mortality Crises of 1346–52 and Advent of the Little Ice Age, in: Dominik Collet/ Maximilian Schuh (eds.), Famines During the 'Little Ice Age' (1300–1800): Socionatural Entanglements in Premodern Societies, Cham 2018, pp.19–41.

7 Wolfgang Behringer, A Cultural History of Climate, Cambridge, Malden 2010, p. 88; Christian Pfister et al., Winters in Europe: The fourteenth century, in: Climatic Change 34/1 (1996), pp. 91–108.

8 Campbell (note 1).

these are the different methods of researching glacier movements in the Swiss Alps,[9] varved lake sediments,[10] and tree rings[11] from Alpine areas. Narrative sources form the basis of several existing climate reconstructions which include the Late Middle Age. These reconstructions focus on central or western continental Europe.[12]

This paper discusses the value of Swiss narrative sources for questions regarding the environmental and climate history of the fourteenth century. Using fourteenth to sixteenth-century sources, the paper aims to answer the following questions: What climatic events do the narrative sources describe? Which events known from other sources do not appear in these texts? Does the information provided in these sources allow for a climate reconstruction? How do the Swiss narrative sources match climate reconstructions based on natural archives?

Section 2 presents an overview on the results of climate reconstructions based on Swiss natural archives. Section 3 briefly introduces the narrative sources analyzed in the study before discussing these and comparing them with the other data in section 4.

9 Heinz J. Zumbühl et al. (eds.), Die Grindelwaldgletscher. Kunst und Wissenschaft, Bern 2016; Hanspeter Holzhauser, Gletscherschwankungen innerhalb der letzten 3200 Jahre am Beispiel des grossen Aletsch- und des Gornergletschers, in: Gletscher im ständigen Wandel. Jubiläums-Symposium der Schweizerischen Gletscherkommission 1993 Verbier (VS): "100 Jahre Gletscherkommission – 100'000 Jahre Gletschergeschichte", Zurich 1995, pp. 101–122.

10 Benjamin Jean-François Amann/ Sönke Szidat/ Martin Grosjean, A millennial-long record of warm season precipitation and flood frequency for the North-western Alps inferred from varved lake sediments: implications for the future, in: Quaternary Science Reviews 115 (2015), pp. 89–100, doi: 10.1016/j.quascirev.2015.03.002; Mathias Trachsel et al., Quantitative summer temperature reconstruction derived from a combined biogenic Si and chironomid record from varved sediments of Lake Silvaplana (south-eastern Swiss Alps) back to AD 1177, in: Quarternary Science Review 29 (2010), pp. 2719–2730, doi: 10.1016/j.quascirev.2010.06.026.

11 Ulf Büntgen et al., A 1052-year tree-ring proxy for Alpine summer temperatures, in: Climate Dynamics 25 (2005), pp. 141–153, doi: 10.1007/s00382-005-0028-1; Ulf Büntgen et al., Summer temperature variations in the European Alps, A.D. 755-2004, in: Journal of Climate 19 (2006), S. 5606–5623, doi.org/10.1175/JCLI3917.1; Edward R. Cook et al., Old World megadroughts and pluvials during the Common Era, in: Science Advances 1/10 (2015), e1500561, doi: 10.1126/sciadv.1500561.

12 Pierre Alexandre, Le climat en Europe au Moyen Age. Contribution à l'histoire des variations climatiques de 1000 à 1425, d'après les sources narratives de l'Europe occidentale, Paris 1987; Gabriela Schwarz-Zanetti, Grundzüge der Klima- und Umweltgeschichte des Hoch- und Spätmittelalters in Mitteleuropa, Zürich 1998; Rüdiger Glaser, Klimageschichte Mitteleuropas. 1200 Jahre Wetter, Klima, Katastrophen. Mit Prognosen für das 21. Jahrhundert, Darmstadt ^{3}2013; Emmanuel Le Roy Ladurie, Histoire humaine et comparée du climat, vol. 1, Canicules et glaciers (XIIIe–XVIIIe siècles), Paris 2004; Christian Pfister et. al., The most severe winters of the fourteenth century in Central Europe compared to some analogues in the more recent past, in: Burkhard Frenzel/ Erik Wishman/ Mirjam Weiss (eds.), Documentary climatic evidence for 1750–1850 and the fourteenth century (Paläoklimaforschung 23), Stuttgart 1998, pp. 45–61; Pfister/ et al. (note 7).

2 Climate of the Fourteenth Century in the Area of Modern Switzerland

In the area of modern Switzerland, the climate of the fourteenth century has been reconstructed based on different natural archives.[13] Glacier movements are driven by the sum of a variety of climatic factors: Roughly said, cold periods lead to advancing glacier tongues, warm periods to melting glaciers. Moisture also plays a major role. The glaciers respond with a time shift (sometimes even of decades) to changing climatic conditions.[14] Advances of the Aletsch Glacier with a peak in about 1370 suggest the beginning of a cold period around 1300.[15] Similar fluctuations were observed at the Gorner Glacier, where a peak occurred around 1385, and at other glaciers in the Swiss Alps.[16] Christian Pfister argues that the peak of the Gorner Glacier's advance is linked to the chilly summers from 1345 to 1347 and a subsequent period of cool, wet summers until 1370.[17]

Another proxy used in climate reconstruction is tree-ring data. Samples collected from trees either close to the timberline in mountainous areas such as the Alps or close to the northern tree limit provide the most useful data. Based on the tree-ring width or density and with the aid of complex statistical measurements and calibration and verification using instrumental measurements of later periods, scholars can calculate the temperatures of the vegetation periods over time.[18] These methods allow not only for the reconstruction of annual series but also for inter-decadal and low frequency (decadal to multidecadal) climate variability. A June-to-September temperature reconstruction based on numerous samples of live trees and historical timber from Canton Valais revealed a cold period starting at the beginning of the fourteenth century with a nadir around 1320. The years 1315 and 1320 were the coldest of that period. Around the middle of the century, temperatures were moderately higher, only

13 For the classification of natural and human-made archives, see Stefan Brönnimann/ Christian Pfister/ Sam White, Archives of Nature and Archives of Societies, in: Sam White/ Christian Pfister/ Franz Mauelshagen (eds.), The Palgrave Handbook of Climate History, London 2018, pp. 27–36.

14 Hanspeter Holzhauser, Die bewegte Vergangenheit des Grossen Aletschgletschers, in: Blätter aus der Walliser Geschichte 41 (2009), pp. 47–102, here pp. 55–56.

15 Holzhauser (note 14), p. 94.

16 Hanspeter Holzhauser, Dendrochronologische Auswertung fossiler Hölzer zur Rekonstruktion der nacheiszeitlichen Gletschergeschichte, in: Bulletin für angewandte Geologie 13 (2008), pp. 23–41, here pp. 26, 32–35.

17 Christian Pfister, Weeping in the Snow. The Second Period of Little Ice Age-type Impacts, 1570–1630, in: Wolfgang Behringer/ Hartmut Lehmann/ Christian Pfister (eds.) Kulturelle Konsequenzen der "Kleinen Eiszeit"/ Cultural Consequences of the "Little Ice Age" (Veröffentlichungen des Max-Planck-Instituts für Geschichte 212), Göttingen, pp. 31–85, here p. 44.

18 Ulf Büntgen/ Jürg Luterbacher, Alpine Klimageschichte vom Hohen Mittelalter bis in die Gegenwart – Was uns Jahrringe und historische Quellen erzählen, in: Blätter aus der Walliser Geschichte 41 (2009), pp. 103–121, here pp. 108–111.

to decrease once again. During the last two decades of the century, the temperatures rose slightly to a low but stable level. Further extraordinarily cold summers occurred in 1360, 1376, 1377, and 1378.[19] Other studies, however, find a period of increased temperatures in the first two to three decades of the century and a period of low temperatures only around 1350. In one of these studies – the reconstruction of June-to-August temperatures of the Alpine area – details reveal that, depending on the positions of the trees, the segment length and inclusion of the tree pith, the results deviate slightly. For instance, larches in Engadine show a temperature decrease in the second decade of the century. The larches in Valais also show this decrease, but with a time-shift of a few years. Deviations between the reconstructed temperature series can be explained by the use of differing calibration methods.[20] In addition, the results are based on different tree species in other areas, and such reconstructions always indicate a range of uncertainty.

Tree rings can also be used to reconstruct precipitation. In the Old World Drought Atlas (OWDA), scholars have access to a database of European June-to-August precipitation indices including year-by-year maps for about two thousand years up until 2012.[21] This reconstruction shows wet summer seasons, particularly between 1314 and 1316, in 1342 and 1343, as well as from 1386 to 1389. Summers were evidently dry from 1304 to 1306, 1318 to 1320, in 1360 and 1361, 1385 and 1393 (see figure 1).

Another reconstruction of summer temperature on the basis of varved sediments from Lake Silvaplana shows a colder period during the second and third decade of the fourteenth century. The temperatures increase after that, only to reach another nadir around the middle of the century. The second half of the century is marked by a increasing temperatures, which fall once again during the last years of the period examined here.[22] Varved lake sediments from Lake Oeschinen form the basis of a summer precipitation reconstruction showing that the fourteenth century was a period of increased wetness, with peaks in warm season precipitation around 1325 and towards the end of the century. Moreover, from 1300 to 1380 flooding was more frequent – with a clear peak around the middle of the century.[23] Lake sediments do not provide yearly but rather decadal resolution.[24]

In summary, according to the reconstructions based on the archives of nature, it can be assumed that a period of lower temperatures began in the early fourteenth century. Temperature decreases occurred mainly during the second and third decade

19 Büntgen et al. (note 11), p. 5615. The exact annual values of the reconstruction are published on the website of the National Oceanic and Atmospheric Administration (NOAA) ftp://ftp.ncdc.noaa.gov/pub/data/paleo/treering/reconstructions/europe/buentgen2011europe.txt (09.01.2019).

20 Büntgen et al. (note 11).

21 Cook et al. (note 11); link to the database: http://drought.memphis.edu/OWDA/Default.aspx

22 Trachsel et al. (note 11), p. 2728.

23 Amann/ Szidat/ Grosjean (note 10), pp. 94–96.

24 Franz Mauelshagen, Klimageschichte der Neuzeit, 1500–1900. Darmstadt 2010, p. 39.

and around the middle of the century. In addition, precipitation was elevated during the second and third decade, as well as in the middle and at the very end of the century. Moreover, floods were more frequent occurrences around the middle of examined period.

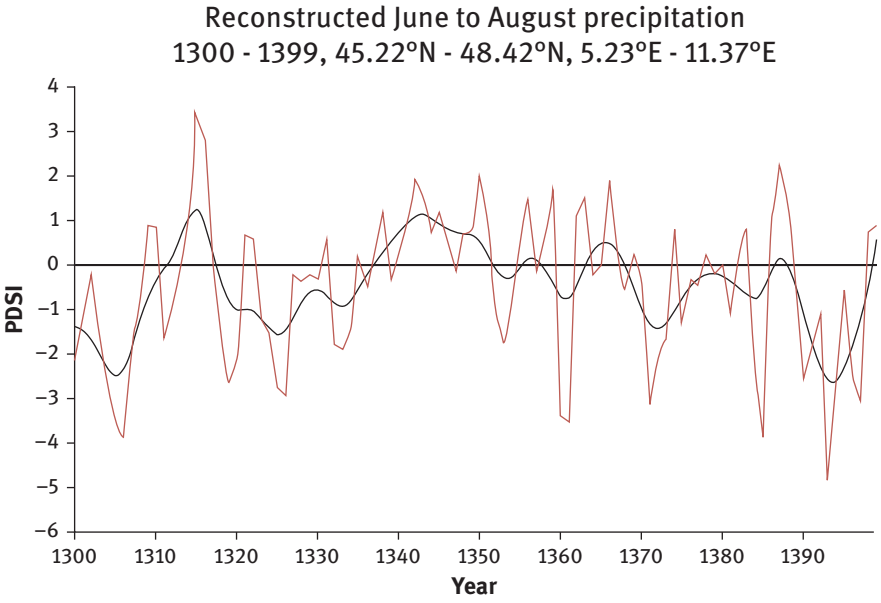

Figure 1: Reconstruction of self-calibrating Palmer Drought Severity Index (PDSI) of June to August precipitation in the area of modern Switzerland derived from Old Worlds Drought Atlas (Cook et al. (note 11) and http://drought.memphis.edu/OWDA).

3 Documentary Sources

Depending on the epoch and the area, detailed and reliable documentary sources for climate reconstructions are often available before instrumental measurement started. In England, a fourteenth-century weather diary includes regular observations on temperature, precipitation, and winds over a period of seven years.[25] From the sixteenth century onwards, such diaries are also found in continental Europe – for instance

25 Kathleen Pribyl, The study of the climate of medieval England: a review of historical climatology's past achievements and future potential, in: Weather 5/29 (2014), pp. 116–120, doi: 10.1002/wea.2317, here pp. 116–117; William Merle, Merle's MS. Consideraciones temperiei pro 7 annis, ed. George James Symons. London 1891.

those of Kilian Leib and Wolfgang Haller, the latter provost in Zurich.[26] Apart from weather diaries, historiographic narrative texts, such as chronicles or annals, often describe weather conditions and their impacts on nature and society. In cases where a sufficient density of weather-related records can be collected, it is thus possible to develop temperature and precipitation reconstructions using climate indices based on such sources.[27] Historical climatologists also reconstruct temperature and/or precipitation derived from information on phenological proxies noted in historical documents, such as grape or grain harvest dates. For the area of modern Switzerland, such series are available for Basel from the late fifteenth century onwards.[28] However, the fourteenth-century Swiss sources are more problematic. Few narrative sources are available for the period of this study, and the available sources refer much less frequently and consistently to the weather than those historical sources outlined above. The information that can be gleaned from this body of evidence is limited, even if written sources recorded in the two subsequent centuries are added to the sample – an addition which requires heightened analytical caution.

The fourteenth-century narrative sources for this region present a number of challenges. In fact, there are few truly contemporary accounts of this period; most of texts which relate events from the early fourteenth century were written much later.[29] One of the most famous truly contemporary sources is the chronicle by Johannes of Winterthur, a Friar Minor who lived in Basel, Schaffhausen, and later Lindau. It was after 1340 in Lindau that he wrote his chronicle. While the focus of the text is, of course, on politics and religious issues, it also repeatedly describes the weather, floods, epidemic diseases, and famines. Johannes of Winterthur is presumed to have died during the Black Death, which he describes in 1348 before the pestilence reached the area around Lake Constance.[30]

---

26 Behringer (note 7), p. 12.

27 E.g., Chantal Camenisch, Endlose Kälte. Witterungsverlauf und Getreidepreise in den Burgundischen Niederlanden im 15. Jahrhundert (Wirtschafts- Sozial- und Umweltgeschichte 5), Basel 2015; Laurent Litzenburger, Une ville face au climat. Metz à la fin du Moyen Âge 1400–1530, Nancy 2015; Jan Buisman, Duizend jaar weer, wind en water in de Lage Landen. Onder redactie van Aryan F. V. van Engelen, vol. 2, 1300–1450, Franeker 1996; Christian Pfister, Wetternachhersage. 500 Jahre Klimavariationen und Naturkatastrophen, Bern 1999.

28 Oliver Wetter/ Christian Pfister, Spring-summer temperatures reconstructed for northern Switzerland and southwestern Germany from winter rye harvest dates, 1454–1970, in: Climate of the Past 7 (2011), pp. 1307–1326, doi: 10.5194/cp-7-1307-2011.

29 Regula Schmid Keeling, Warum Morgarten? Hintergründe und Erklärungen, in: Der Geschichtsfreund 168 (2015), pp. 21–43, here p. 24.

30 Friedrich Baethgen, Einleitung, in: Id. (ed.), Die Chronik Johanns von Winterthur (Monumenta Germaniae Historica, Scriptores Rerum Germanicarum, Nova Series 3), Berlin 1924, pp. VII–XXXVII, here pp. XIX–XXXI; Arno Borst, Johann von Winterthur. Franziskaner in Lindau, in: id., Mönche am Bodensee: 610–1525 (Bodensee-Bibliothek 5), Sigmaringen 1978, pp. 264–281; Christine Putzo, Johannes von Winterthur, in: Encyclopedia of the Medieval Chronicle, vol. 2 (2010), pp. 926–927.

A second source for this study is the anonymous chronicle of the town of Zurich, which starts with the foundation of Zurich in antiquity and ends in 1418, though there are a number of anonymous continuations. From about 1380 onwards, it is considered a contemporary account of events that occurred in and around Zurich.[31] Committed to parchment around 1415, probably by a lay townsman instead of a cleric, the Zurich chronicle also contains rich descriptions of remarkable weather and other environmental events. Since the author did not copy the most important documents for the history of Zurich into his chronicle, it is unlikely that he had access to the town's chancellery.

The 'Grössere Basler Annalen', written down in 1412 (with a short continuation until 1416), are a rich source for the history of Basel and its surroundings. The annals start in the year 1275; from 1315 onwards, they are considered a reliable – and from 1370 a contemporary – description of events around Basel.[32] Basel is also mentioned frequently in the 'Rötteler Chronik,' which was originally the private chronicle of a noble family in the Markgräflerland region adjacent to the Swiss border. Written in the first half of the fifteenth century, it also covers the last quarter of the previous century with occasional references to weather conditions.[33]

In 1420, the town council of Bern commissioned a scribe in the local chancellery, Conrad Justinger, to write an official chronicle of the town's history in the preceding centuries. Justinger himself had not been born until around 1370, meaning he had not experienced most of the century personally. However, he drew upon quite reliable sources for his account of the earlier part of the fourteenth century, a period during which Bern expanded considerably despite having to stand its ground against opponents. Justinger's chronicle focuses on politics, especially alliances with different nearby towns, and the military campaigns that resulted in the expansion of Bernese territory.[34] From time to time, mainly in his account of the latter half of the fourteenth century, Justinger also mentions events related to the environment.

In the course of the fifteenth century, the Swiss illustrated chronicles developed, in which self-confident towns in the Swiss Confederacy aimed to present their own history in the form of town chronicles.[35] Around 1474, Bern commissioned a local scribe, Diebold Schilling, to write a continuation of Conrad Justinger's official

31 Johannes Dierauer, Einleitung, in: Id. (ed.), Chronik der Stadt Zürich (Quellen zur Schweizer Geschichte 18), Basel 1900, pp. IX–XLVI, here pp. IX–XIX; Gabriel Viehhauser, Chronik der Stadt Zürich, in: Encyclopedia of the Medieval Chronicle, vol. 1 (2010), pp. 431–432.

32 August Bernoulli, Einleitung, in: Id. (ed.), Basler Chroniken, 5, Leipzig 1895, pp. 3–14.

33 Ibid., pp. 105–119; Albrecht Classen, Rötteler Chronik, in: Encyclopedia of the Medieval Chronicle, vol. 2 (2010), pp. 1300.

34 Gottlieb Studer, Einleitung, in: Id. (ed.), Die Berner-Chronik des Conrad Justinger, Bern 1871, pp. I–XXXVII, here pp. XIV–XXIV; Kathrin Jost, Konrad Justinger (ca. 1365–1438): Chronist und Finanzmann in Berns Grosser Zeit (Konstanzer Arbeitskreis für mittelalterliche Geschichte, Vorträge und Forschungen 56), Ostfildern 2011, pp. 195–196.

35 Carl Pfaff, Die Welt der Schweizer Bilderchroniken, Schwyz 1991, p. 9.

chronicle.[36] Schilling subsequently wrote both the official chronicle of Bern and a private chronicle, the so-called 'Spiezer Chronik,' for the noble Rudolf von Erlach around 1484.[37] A comparison to Schilling's official town account, the 'Grosse Burgunderchronik' reveals some deviation between the two texts.[38]

A few years earlier, around 1470, Benedict Tschachtlan and Heinrich Dittlinger, two influential Bernese politicians,[39] wrote their own chronicle of Bern; this is a private chronicle rather than an official chronicle like Schilling's.[40] The older sections mainly copy Justinger's text, adding a further source on the Old Zurich War (1440–1450).[41]

During the sixteenth century, in the wake of the Protestant Reformation, further chronicles intended to glorify the early history of the Swiss Confederacy and inspire the members of both confessions to preserve their political union. An example of such texts is the *oeuvre* of Aegidius Tschudi of Glarus, a Swiss Humanist. As a young man, Tschudi, himself Catholic, was deeply concerned with confessional reconciliation. With age, however, he became more and more a religious fanatic. His 'Chronicon Helveticum' traces the history of the area of the Swiss Confederacy from 1000 to 1470.[42]

The first printed chronicle in the examined area was the *Kronica von der loblichen Eydtgnoschaft, jr harkommen und sust seltzam strittenn und geschichten* by Petermann Etterlin from Lucerne, which appeared in 1507. He used various humanist sources in the composition of his text, such as Hartmut Schedel's *Weltchronik*.[43]

Besides these two lengthy, well known historiographical works, there are a number of shorter texts including the 'Zurich Annals', which are a compilation of handwritten notes about Zurich in a printed volume of Etterlin's chronicle. August

36 Regula Schmid Keeling, Schweizer Chroniken, in: Gerhard Wolf/ Norbert H. Ott (eds.), Handbuch Chroniken des Mittelalters, Berlin, Boston 2016, pp. 267–300, here p. 281.

37 Urs Martin Zahnd, Beschreibung der Handschrift, in: Hans Haeberli/ Christoph von Steiger (eds.), Die Schweiz im Mittelalter in Diebold Schillings Spiezer Bilderchronik. Studienausgabe zur Faksimile-Edition der Handschrift Mss. hist. helv. I. 16 der Burgerbibliothek Bern, Lucerne 1991, pp. 1–6, here p. 1.

38 Jean-Pierre Bodmer, Chroniken und Chronisten im Spätmittelalter (Monographien zur Schweizer Geschichte 10), Bern 1976, p. 43.

39 Hans A. Michel, Die Chronisten Bendicht Tschachtlan und Heinrich Dittlinger im Bernischen Staatsdienst, in: Alfred A. Schmid (ed.), Tschachtlans Bilderchronik. Kommentar zur Faksimile Ausgabe der Handschrift Ms. A 120 der Zentralbibliothek Zürich, Lucerne 1988, pp. 27–53.

40 Richard Feller/ Edgar Bonjour, Geschichtsschreibung der Schweiz. Vom Spätmittelalter zur Neuzeit, vol. 1, Basel, Stuttgart 1962, p. 31.

41 Regula Schmid Keeling, Schweizer Chroniken, in: Gerhard Wolf/ Norbert H. Ott (eds.), Handbuch Chroniken des Mittelalters, Berlin, Boston 2016, pp. 267–300, here pp. 279–280; Pascal Ladner, Die Tschachtlan-Chronik als Geschichtswerk, in: Alfred A. Schmid (ed.), Tschachtlans Bilderchronik. Kommentar zur Faksimile Ausgabe der Handschrift Ms. A 120 der Zentralbibliothek Zürich, Lucerne 1988, pp. 77–84.

42 Feller/ Bonjour (note 40), pp. 312–325.

43 Schmid Keeling (note 41), pp. 297–298.

Bernoulli, who published these notes in the nineteenth century, argued that the handwriting is typical of the first half of the sixteenth century.[44] All these texts do not focus on weather, but in some remarkable cases, they give a description of weather conditions – often in the context of the climate's impacts on society.

4 Events Described

The Great Famine, which began in 1315, is a well-established event in several areas throughout Europe.[45] During the twelfth and thirteenth centuries, the European population was increasing rapidly, requiring the cultivation of more and more land[46] and the introduction of new more intensive, specialized methods of agricultural production.[47] This population pressure and the limits of agricultural yields made these societies vulnerable to external shocks.[48] A series of inclement years from 1314 to 1317 witnessed increased precipitation, especially in the summers, which caused massive crop failures that drove the price of food up dramatically. The resulting famine sparked a massive demographic decline, as people both starved directly and fell prey to the epidemics that spread easily due to undernourishment.[49] With regard to the area of modern Switzerland, information on this famine is quite sparse. On the one hand, it is most probable that the area of the Swiss Plateau also suffered since the Holy Roman Empire, France, Scandinavia, the British Isles, and even parts of the Baltic were affected by the crisis. On the other hand, the Alpine parts of Austria – rather self-sustainable areas – seemed to be spared, so it is possible that not all Swiss regions were affected in the same way.[50]

Johannes of Winterthur mentions the famine, but he gives the year 1313 – probably erroneously. In his description, Johannes attributes the famine to many places on

44 August Bernoulli, Ueber Zürcher Annalen des XIV. Jahrhunderts, in: Anzeiger für Schweizerische Geschichte 22/6 (1891), pp. 273–275.

45 E.g., William Chester Jordan, The Great Famine. Northern Europe in the Early Fourteenth Century, Princeton 1996.

46 Campbell (note 1), pp. 58–65; Behringer (note 7), pp. 80–81.

47 Bas van Bavel, Manors and Markets. Economy and Society in the Low Countries, 500–1600, Oxford, New York 2010, p. 325.

48 On the concept of vulnerability of society against hunger see Daniel Krämer, Vulnerabilität und die konzeptionellen Strukturen des Hungers. Eine methodische Annäherung, in: Dominik Collet/ Thore Lassen/ Ansgar Schanbacher (eds.), Handeln in Hungerkrisen. Neue Perspektiven auf soziale und klimatische Vulnerabilität. Göttingen 2012, pp. 45–65; Daniel Krämer, 'Menschen grasten nun mit dem Vieh'. Die letzte grosse Hungerkrise der Schweiz 1816/17 (Wirtschafts-, Sozial- und Umweltgeschichte 4), Basel 2015, pp. 192–212.

49 Henry S. Lucas, The Great European Famine of 1315, 1316, and 1317, in: Speculum 5/4 (1930), pp. 343–377, here pp. 345–352; Cook et al. (note 11), here p. 3.

50 Jordan (note 45), pp. 7–11.

this earth, but he especially mentions Colmar in Alsatia, where hundreds were buried in two trenches outside the town walls:

> 1313. Around this time, many people died in an Alsatian city called Colmar due to a dearth, which occurred in many parts of the world. 3,700 people were buried in two hastily prepared trenches outside the city walls. In other nations, 99,000 people perished, to a large extent in Westrich [parts of the Palatinate, Saarland, Lorraine, and Alsatia] and Lorraine.[51]

The 'Grössere Basler Annalen' give an account of the famine and the considerable number of people starving:

> In the year 1317, there was a great dearth in Basel. One viertel [measure of capacity] rye cost 5 pounds, one viertel spelt 3 pounds, one viertel oats 1 pound 10 shilling. Many people perished because they ate all kinds of food.[52]

It is remarkable that the chroniclers indicate different years: 1313 and 1317. Neither of them suggests that the dearth lasted for more than one year. The 'Annales Sancti Victoris Gebennensis' – a chronicle from Geneva – dates the famine to the year 1322.[53] This example shows that dating might be a problem even with contemporary accounts. In retrospect, more than two hundred years later, Tschudi knew that this famine had lasted for at least two years. Since the horror of dying people during that crisis was already distant, it is hardly surprising that his description is brief and includes only two rye prices alongside mention of the dearth and the high mortality rate:

> In this year 1316, [...] a viertel rye cost 30 shillings in Bern and, in the countryside, 2 pounds. And the dearth lasted until the next year and was followed by a great mortality.[54]

---

51 *1313. Circiter ista tempore propter karistiam, que invaluerat in pluribus mundi partibus, perierunt nimia pre fame in civitate Alsacie dicta Colmur tot homines, quod in duabus foveis extra muros ad hoc paratis sepulti fuerant XX et XVII centena et in aliis tribus LXXX. XIX centena hominum, qui pro maiori parte de Westerrich et de Lothoringia, ut fertur, extiterunt. Nam illic fames crudelius inhorruerat et, ut eam homines ibidem habitantes effugerent, ad civitatem prenominatam terre fructibus tunc magis exuberantem turmatim confluxerunt.* Friedrich Baethgen (ed.), Die Chronik Johanns von Winterthur (Monumenta Germaniae Historica, Scriptores Rerum Germanicarum, Nova Series 3), Berlin 1924, p. 76. English translation by the author.

52 *Anno 1317 was ein grosse thúre zů Basel; galt ein viertel roggen 5 lb, und 1 viertzel korn 3 lb, 1 viertzel habren 1 lb 10s; sturben vil lúten, das sy allerley ossen.* August Bernoulli (ed.), Die Grösseren Basler Annalen. 238–1416, in: Id. (ed.), Basler Chroniken, 5, Leipzig 1895, pp. 15–50, here p. 18. In other manuscript versions, the people perish because they starve. English translation by the author.

53 Edouard Mallet (ed.), Fasciculus Temporis. Chronica Monasterii Sancti Victoris Gebennensis?, in: Mémoires et documents publiés par la Société d'histoire et d'archéologie de Genève 9 (1855), pp. 300–309, here p. 305–306.

54 *Dis 1316. jars [...] galt ein viertel roggen zů Bern 30 ß und uff dem land 2 lib., und weret diese thüri bis in das ander jar, und kame in grosser sterbent daruf.* Bernhard Stettler (ed.), Aegidius Tschudi, Chronicon Helveticum, 4 (Quellen zur Schweizer Geschichte, Neue Folge, 1. Abteilung: Chroniken, VII/4), Basel 1983, p. 18. English translation by the author.

Because these events were traumatic for so many people, one would expect the famine to be described in all the narrative sources examined. Surprisingly, this is not the case. For example, the chronicle of the town of Zurich, which is rich with later comparable accounts, does not mention the famine at all.[55] The same is the case with the 'Nüwe Casus' and Benedict Tschachtlan's chronicle.[56] It is also remarkable that all the texts remain silent about the reasons for the famine. Sources from other part of Europe prove that extended rainfalls and low temperatures during the summers from 1314 to 1317 destroyed harvests.[57] A comparison with the aforementioned temperature and precipitation reconstructions based on varved lake sediments and tree rings shows that cold, wet conditions during these summers are also plausible for the area of Switzerland. The history of the glacier advances likewise confirms a cold period during the first decades of the fourteenth century. The evidence of cold and wet weather gathered from climate proxies located in Alpine areas – together with the written sources here presented – suggests strongly that the area of Switzerland was not spared from the Great Famine.

Almost all the texts used for this study include an account of the St. Mary Magdalene's Flood in 1342 and the subsequent flood in the following year. The magnitude of these events was enormous and reached far beyond the area of modern Switzerland.[58]

According to Johannes of Winterthur, there had been a terrible flood in Hungary along the Danube already in February 1342. In summer of the same year, in what came to be known as the St. Mary Magdalene's flood, the river burst its banks in the German countries. Finally, according to Johannes's account, Lombardy was affected by floods in November:

---

55 Johannes Dierauer (ed.), Chronik der Stadt Zürich (Quellen zur Schweizer Geschichte 18), Basel 1900, pp. 1–271.

56 Eugen Nyffenegger (ed.), Cristân der Kuchimaister, Nüwe Casus Monasterii Sancti Galli. Edition und sprachgeschichtliche Einordnung (Quellen und Forschungen zur Sprach- und Kulturgeschichte der germanischen Völker 60), Berlin, New York 1974; Pascal Ladner, Textedition, in: Alfred A. Schmid (ed.), Tschachtlans Bilderchronik. Kommentar zur Faksimile Ausgabe der Handschrift Ms. A 120 der Zentralbibliothek Zürich, Lucerne 1988, pp. 139–439.

57 E.g., Glaser (note 12), pp. 64–65.

58 Christian Rohr, Extreme Naturereignisse im Ostalpenraum. Naturerfahrung im Spätmittelalter und am Beginn der Neuzeit (Umwelthistorische Forschungen 4), Cologne, Weimar, Vienna 2007, p. 227–228; Martin Bauch, Die Magdalenenflut 1342 – ein unterschätztes Jahrtausendereignis?, in: Mittelalter. Interdisziplinäre Forschung und Rezeptionsgeschichte, 4. Februar 2014, http://mittelalter.hypotheses.org/3016; Hans-Rudolf Bork/ Arno Beyer/ Annegret Kranz, Der 1000-jährige Niederschlag des Jahres 1342 und seine Folgen in Europa, in: Falko Daim/ Detlef Gronenborn/ Rainer Schreg (eds.), Strategien zum Überleben. Umweltkrisen und ihre Bewältigung, Mainz 2011, pp. 231–242; Hans-Rudolf Bork et al., Spuren des tausendjährigen Niederschlags von 1342, in: Hans-Rudolf Bork (ed.), Landschaften der Erde unter dem Einfluss des Menschen, Darmstadt 2006, pp. 115–120; Hans-Rudolf Bork/ Markus Dotterweich, Jahrtausendflut 1342, Archäologie in Deutschland 4 (2007), pp. 20–23.

> In the year of incarnation of the Lord 1342, the River Danube rose extensively due to snow around the Feast of the Purification of the Blessed Virgin Mary [2 February] [...]. Moreover, in the summer of this year, such a large flood occurred as a consequence of rain and rising waters [...]. Around the Feast of Saint Martin [November 11], excessive rainfalls caused a large flood that affected the city of Padua and other parts of Lombardy [...].[59]

For 1343, the same chronicler reports that a famine in the German countries became so severe that people shook with hunger. According to Johannes, it was continuous rainfall and hail that had devastated the entire harvest and caused the famine. The excessive rainfall caused further flooding in central and northeastern Switzerland, where Lake Constance and several rivers burst their banks in a number of places, flooding towns and the surrounding countryside:

> Moreover, in this year [1343], at the beginning of September around the feast of Saint Bartholomew, Lake Constance and surrounding rivers flooded due to continuing and immoderate rainfalls. [...] Moreover, in the summer of this year, the Reuss river flooded the whole city of Lucerne due to a sudden rise of water which occurred because of the excessive rainfalls. [...] Also the small unnavigable river called Töss near Winterthur flooded its surroundings. [...].[60]

For the chronology of the weather events, it is crucial that Johannes mentions both floods – in 1342 and 1343 – in these two passages.[61] Without such a reliable description in one single text of similar events occurring in two subsequent years, these events could easily be conflated as one event.

Moreover, the anonymous annals of Zurich mention the severe flood in same town around 25 July 1343:

> Flood in Zurich in the year of the Lord 1343, on the Feast of Saint James [25 July]. The water rose to such an extent that it flew over both bridges, and it also flooded the Sihlfeld [a meadow nearby].[62]

---

59 *Anno dominice incarnacionis MCCCXLII. Danubius fluvius nivibus resolutis circa festum purificacionis beate Marie in tantum excrevit, [...]. [...] Preterea eodem anno in estate in partibus Alemanie tanta fuit facta inundacia ynbrium et excrescencia aquarum, [...]. [...] citra festum sancti Martini, aput civitatem Paduanam et aliis partibus Longobardie propter pluviarum excessum tanta aquarum inundancia excrevit, [...].* Baethgen (note 51), pp. 189, 191, 195. English translation by the author.

60 *Item eodem anno [1343] in kalendis Septembris circiter festum sancti Bartholomei propter pluviarum continuitatem et immoderanciam lacus Potannicus et fluvii circumque tantum excreverunt, [...]. Item eodem anno, [...] tempore estivalis in una excrescencia aquarum excessive propter ymbrium immensitatem fluvius Růsa oppidum Lucernense preterfluens tantum excrevit, [...], Parvus quoque fluvius innavigabilis aput oppidum Wintertur fluens Tősa nuncupatus tantum inundavit, [...]. Sunt autem ista, quod in una excrescencia importuna et a retroactis temporibus insweta et inaudita Reni fluvii supra memorata homines pericola rerum corporumque metus et terrors horribiles incurrerunt et dampna.* Baethgen (note 51), pp. 206, 213, 215. English translation by the author.

61 Regarding the floods in these years, see Andrea Kiss, Floods and weather in 1342 and 1343 in the Carpathian Basin, in: Journal of Environmental Geography 3–4/2 (2009), pp. 37–47.

62 *Diluvium in Zurich anno ec 1343, in die s. Jacobi, sic quod aqua ascendebat ultra ambis pontes; und gieng uber das Silveld hinweg.* August Bernoulli (ed.), Annalen 1308–1389, in: Anzeiger für Schweizerische Geschichte 22/6 (1891), pp. 275–278, here p. 275. English translation by the author.

The chronicle of the town of Zurich depicts the same event in different words and gives some additional information about the destruction of houses and infrastructure:

> In the year of the Lord 1343, on the Feast of Saint James [25 July], the water level rose a great deal, and a surge flooded both bridges in Zurich and it also flooded the Sihlfeld. It was necessary to weight down the deluged bridges with "torkelbäume" [heavy vine presses] and large rocks. Hans Müller's large house and three mills were washed away by the Aa river [Limmat] during the night. The debris impounded the river at the bridge near the Hardturm. While people were trying to clear the debris of the house (from the bridges pillars), the bridge collapsed and was washed away. People went into Fraumünster church by ship.[63]

In this account, as well, both bridges in Zurich were flooded. People tried to secure them by weighing down the constructions with the massive, heavy logs used in wine presses and with stones. A house and three mills, which were adjacent to small bridges in Zurich, were washed away. Like driftwood, their debris endangered and finally destroyed a bridge further downstream.

The 'Kleinere Basler Annalen,' also contain evidence of a flood along the Rhine on 25 July:

> In the year of the Lord 1340, on the Feast of the Apostle James [25 July], a Rhine flood occurred, which ripped apart the Rhine bridges in Basel, Laufenburg, Säckingen, Rheinfelden, and Breisach and led to great damage in the countryside.[64]

The chronicler dates the flood to the year 1340. The editor of the annals argued already in the early twentieth century that the events described happened in 1343 and not in 1340.[65] The 'Grössere Basler Annalen' likewise date the flood event to the year 1340.[66] Of course, the chroniclers from Basel were mistaken – the descriptions of these events which all occurred on the Feast of Saint James are too similar to be a coincidence. Evidence from throughout Europe overwhelmingly suggests that this flood occurred in 1343.

The tree-ring-based OWDA confirms wet weather conditions in 1342 and 1343, whereas the varved sediments from Lake Oeschinen also display an increased flood

---

63 *Anno domini 1343 jar, an sant Jacobs tag, do wart das wasser so grus, das es Zúrich* über *beid bruggen gieng von dem grossen wůtgús, und gieng* über *das Silveld. Und můt man die bruggen beswaren mit trotbőimen und standen vol wassers und mit groβen steinen. Und ran das groβ hus enweg, und runnent dri múllinen uf der A mit dem hus enweg, das Hans Müllers was, in der nacht, und gestůnd an der brugg, dú im Hard an dem turn* über *gieng. Un do man das hus sleizen wolt, do brach die brugg und ran als enweg. Und fůr man ouch ze Frőwenmúnster in der kilchen mit schiffen*. Dierauer (note 55), pp. 44–45. English translation by the author.

64 *Anno domini 1340 an sant Jacobs tag des zwelfbotten do kame in grosser Rin, der fůrt die Rinbrúgge enweg ze Basel, ze Lőfenberg, ze Sekingen, ze Rinvelden und ze Brisach, und tet grosen schaden in dem lande*. August Bernoulli (ed.), Die Kleineren Basel Annalen. 1308–1415, in: Id. (ed.), Basler Chroniken, 5, Leipzig 1895, pp. 55–67, here p. 56. English translation by the author.

65 Baethgen (note 51), p. 215.

66 Bernoulli (note 52), p. 20.

frequency around the middle of the fourteenth century. Moreover, contemporary witnesses experienced the flooding as a remarkable event. Aegidius Tschudi's account overlaps with that outlined above, adding that, after to the Limmat flood in Zurich, people erected a stone marker in the Niederdorf to remember the height of the water in 1343:

> A stone with an inscription was erected on the street in the city of Zurich [Niederdorf] where the tavern "Sternen" is located, for the purpose of commemorating the depth of the water.[67]

One of the most defining disasters of the fourteenth century was the Black Death. The bacterium *Yersinia Pestis*, which caused this epidemic,[68] originated in Asia and presumably travelled along the Silk Roads to Europe. The plague reached the north shore of the Black Sea in 1347, claiming its first victims in Constantinople in the same year. Shortly thereafter, it had arrived in Sicily and in Marseilles, and it spread from there to the harbor towns of the Adriatic and Tyrrhenian Seas. By the spring of 1348, the Black Death was also raging in the German countries.[69] The spread of the disease was influenced and considerably favored by the climatic conditions of the epoch and the weather of the respective years.[70]

The sources reviewed for this study describe three phenomena around the Black Death, of which two were linked only indirectly to the plague. As one might expect, the chronicles go into some depth regarding the epidemic's spread and its typical characteristics. Several of the local chronicles also mention flagellants, which were a manifestation of the collective panic that afflicted people faced with this devastating disease and soaring mortality rates.[71] However, flagellants had already appeared before the Black Death hit Europe, and, therefore, this religious movement was not caused by the plague but rather intensified by it.[72]

Others reacted by looking for scapegoats to blame for the epidemic: The chronicles also report how, in several towns in the Holy Roman Empire, Jews were suspected of having poisoned city wells. These accusations resulted in antisemitic violence and pogroms during this period.[73] Of course, pogroms had occurred long before this time

---

67 *Do ward der stein mit der geschrifft an der gassen uff Dorf genant zů Zurich in der statt ufgericht, der bim wirtzhus zum Sternen stat, zů einer gedächtnus wie hoch das wasser domaln geflossen.* Stettler (note 54), pp. 316–317. English translation by the author.

68 Kirsten I. Bos et al., A draft genome of Yersinia pestis from victims of the Black Death, in: Nature 478 (2011), pp. 506–510.

69 Klaus Bergdolt, Der Schwarze Tod in Europa. Die grosse Pest und das Ende des Mittelalters, Munich 1994, pp. 33–80.

70 Campbell (note 1), pp. 3–19.

71 Bergdolt (note 69), p. 107.

72 František GRAUS, Pest – Geißler – Judenmorde. Das 14. Jahrhundert als Krisenzeit (Veröffentlichungen des Max-Planck-Instituts für Geschichte 86), Göttingen ^{2}1988, p. 43.

73 Bergdolt (note 69), p. 107.

and independently of the plague, and the idea of minorities poisoning well water in order to cause epidemic diseases was also not new.[74]

Johannes of Winterthur briefly mentions the Black Death twice in his entry for 1348. He tells how countless people perished in Sicily, Avignon, and Marseilles. In Messina, all the brethren of the Carmelite Convent and the hermits there perished from this unknown disease.[75]

Conrad Justinger also writes about the disease in Bern in 1349, reporting that many days about sixty bodies had to be carried out of the town. The plague also affected those living in the countryside.[76] Diebold Schilling incorporates this passage into his 'Spiezer Chronik,' as does Benedict Tschachtlan into his account. Furthermore, Schilling and Tschachtlan tell of unmanned ships at sea after their entire crews died of the plague:

> And people say that many ship crews died at sea, and, therefore, nobody steered the ships.[77]

Tschudi wrote his chronicle two centuries after the Black Death had ravaged this area; he still has a sense that the Black Death was a unique and remarkable demographic catastrophe that left many towns, monasteries, landscapes, and islands nearly devoid of human inhabitants:

> In the same year, 1348, and also in the following, an unprecedented and cruel mortality occurred throughout Christendom. As a consequence of that, [the populations of] many cities, towns, monasteries, countrysides, and island almost became extinct.[78]

The flagellants are also mentioned in some of the narrative sources under consideration here. Justinger tells us that they came to Bern in 1349.[79] Tschudi describes how they whipped themselves in public, wandering from one place to another. According to Tschudi, this fanatical movement attracted people from all classes and included

---

74 František Graus, Judenfeindschaft im Mittelalter, in: Wolfgang Benz/ Werner Bergmann (eds.) Vorurteil und Völkermord. Entwicklungslinien des Antisemitismus. Freiburg, Basel, Vienna 1997, pp. 35–60, here pp. 40–43, 50–53.

75 Baethgen (note 51), pp. 275–276, 279.

76 Gottlieb Studer (ed.), Conrad Justinger, Chronicka der Stadt Bern, in: Id. (ed.), Die Berner-Chronik des Conrad Justinger, Bern 1871, pp. 1–291, p. 111.

77 *Ouch seit man fúr war, daß uf dem mere in etlichen schiffen die lút gantz ußsturben, daß die schif nieman fůrt*. Urs Martin Zahnd (ed.), Textedition, in: Hans Haeberli/ Christoph von Steiger (eds.), Die Schweiz im Mittelalter in Diebold Schillings Spiezer Bilderchronik. Studienausgabe zur Faksimile-Edition der Handschrift Mss. hist. helv. I. 16 der Burgerbibliothek Bern, Lucerne 1991, pp. 455–578, here p. 504; Ladner (note 56), p. 203. English translation by the author.

78 *Des selben 1348. jars und ouch das nechstvolgende daruf was ein mercklicher unerhörter grusamer sterbend in gantzer christenheit, also das vil stett flecken clöster landschafften und inslen schier gar uβsturbent*. Stettler (note 54), p. 345. English translation by the author.

79 Studer (note 76), p. 111; Zahnd (note 77), p. 504.

noblemen, priests, citizens, countrymen, sundry craftspeople, and wealthy individuals. As the chronicler says, an amazing number of people joined that horde.[80]

Moreover, Justinger and Schilling report that Jews were blamed for poisoning wells all over the world. Obviously, they had doubts about the truth of the story, since they use the term *verlûmdet*, which means "defame."[81] Tschudi also describes the pogroms which ensued and how many Jews committed suicide by burning their own houses to avoid falling into the hands of the angry mob.[82]

The major annals from Basel give only a brief account of the events linked to the Black Death. They mention the both flagellants and the epidemic disease. Because the Jews were blamed for the plague, they were burned in Basel, Zurich, and Augsburg, according to these annals.[83] There are even narrative texts, such as the anonymous annals of Zurich, that do not mention the Black Death at all. Astonishingly, in the text from Zurich, the author reports that all the Jews in Zurich were burned in 1349 but says nothing else about those years, not even mentioning the plague.[84] Keeping in mind that these annals were written as additions to a printed edition of Etterlin's 'Kronica von der loblichen Eydtgnoschaft,' the author presumably considered it unnecessary to add anything further about the Black Death. However, Etterlin himself describes only the flagellants in his work without explicitly mentioning the Black Death.[85] Of course Etterlin's chronicle was committed to paper more than 150 years after these events.

Europe experienced an exceptional winter in 1363/1364. The written records in many places report on the bitter cold temperatures and the bodies of water which froze during this time.[86]

The authors of the chronicle of the town of Zurich and the 'Klingenberger Chronik' give an account of extremely low temperatures in this winter, when Lake Zurich froze over so solidly that horses and carriages could travel over it. The ice lasted until Good Friday, 30 March 1364, but had thawed by the evening of Easter.[87] As Justinger describes – and Schilling as well as Tschachtlan repeat in their accounts – the winter of 1363 was terribly cold all over the German countries, and the icy temperatures

80 Stettler (note 54), p. 333.

81 Studer (note 76), p. 111; Zahnd (note 77), p. 504.

82 Stettler (note 54), pp. 345–347. Regarding the suicide of Jews facing conversion (Kiddush Hashem) see Simha Goldin, Apostasy and Jewish identity in High Middle Ages. Manchester 2014, pp. 67–68, 79–80.

83 Bernoulli (note 52), p. 20.

84 Bernoulli (note 44), p. 275.

85 Eugen Gruber (ed.), Petermann Etterlin, Kronica von der loblichen Eytgnoschaft, jr harkommen und sust seltzam strittenn und geschichten (Quellenwerk zur Entstehung der Schweizerischen Eidgenossenschaft, Abteilung III: Chroniken und Dichtungen 3), Aarau 1965, p. 124.

86 Glaser (note 12), p. 77.

87 Bernhard Stettler (ed.), Die sogenannte Klingenberger Chronik des Eberhard Wůst, Stadtschreiber von Rapperswil (Mitteilungen zur vaterländischen Geschichte 53), St. Gallen 2007, p. 125; Dierauer (note 55), p. 81.

lasted through March.[88] The anonymous town chronicle apparently contains an error; it copies Justinger's text more or less verbatim but reports that the frost lasted until May.[89] The 'Kleinere Basler Annalen' also provide details regarding the exact dating, claiming that winter began on 13 December and lasted fourteen weeks until March:

> In the year of the Lord 1364 occurred a cold winter. This winter began on the day of Saint Lucius' Feast [3 December] and lasted for 14 weeks without interruption.[90]

This cold winter cannot appear in tree-ring based temperature reconstructions because tree rings only indicate weather conditions during the trees' vegetation period.

There are also other especially cold or warm seasons, thunderstorms, comets, and further remarkable events mentioned only in few sources or only in one source, such as a flood in 1387 in Fribourg. An anonymous chronicle of that town describes the event on the day before Saint Francis (3 October). The Sarine, a river that crosses the city, burst its river banks and destroyed all the mills and some houses and barns:

> In this year, 1387, on the eve of the Feast of Saint Francis [4 October], the water rose of the Sarine river that flows across Fribourg to such an extent that all the mills, and many houses and barns, were destroyed.[91]

Indeed, also the OWDA and the varved sediments from Lake Oeschinen show particularly wet weather conditions in the years from 1386 to 1389, and again around the end of the century.

As a final example, the summer of 1393 was extremely hot and dry. Justinger tells his readers that it was so dry that the soil was like ash. No rain fell in the period between the time when the barley was sown, nor when it was harvested, milled, baked, or eaten.[92] The drought is reported in other places in Europe; a number of rivers including the Rhine and Mosel fell to remarkably low levels.[93] Once again, the same drought is also visible in the year 1393 in the OWDA.

---

88 Studer (note 76), p. 124; Zahnd (note 77), p. 510; Ladner (note 56), p. 210.

89 Gottlieb Studer (ed.), Die anonyme Stadtchronik, in: Id (ed.), Die Berner-Chronik des Conrad Justinger. Nebst vier Beilagen, Bern 1871, pp. 314–466, p. 391.

90 *Anno domini 1364 do was ein kalter winter. Und vieng der selbe winter an sant Lucien tag an, und wert 14 wochen ganze an enander, das underlibung ni was.* August Bernoulli (ed.), Die Kleineren Basel Annalen. 1308–1415, in: Id. (ed.), Basler Chroniken, 5, Leipzig 1895, pp. 55–67, here p. 57. English translation by the author.

91 *In eodem anno 1387 in vigilia S. Francisci crevit serona aqua juxta Friburgum in tantum, quod omnia molendia, aliquas domos et horrea destruxit.* Gottlieb Studer (ed.), Anonymus Friburgensis, in: Gottlieb Studer (ed.), Die Berner-Chronik des Conrad Justinger, Bern 1871, pp. 467–477, here p. 470. English translation by the author. Pascal Ladner shows that there is no other evidence for this flood. See Pascal Ladner, Spätmittelalterliche und frühneuzeitliche Freiburger Quellenbelege zu Klima und Meteorologie, in: Blätter aus der Walliser Geschichte 38 (2006), pp. 207–230, here p. 215.

92 Studer (note 76), p. 178.

93 Glaser (note 12), p. 67; Rohr (note 89), pp. 442–443. Christian Rohr dates the event to the year 1394, although the chronicle gives the year 1393.

5 Conclusion

The selection of narrative sources presented here shows that the texts describe only a part of those extreme weather events that occurred during the period examined. The most obvious case is the Great Famine: given its dramatic nature, one might expect these sources to report on it in more detail. Instead, the few texts which mention the famine at all do not go into great detail or try to explain its causes. Again, the sources seem incomplete regarding the floods in 1342 and 1343. Only Johannes of Winterthur describes events in both years, the other sources focus only on one. Therefore, further analysis will be necessary in order to determine the exact chronology of floods in those years.

This source availability differs from weather sensitive sources in other areas and epochs. Moreover, the comparison of the Swiss narrative sources with the reconstructions based on proxies from natural archives, such as tree rings, varved lake sediments, and glacier movements, suggest information is missing in the written texts. Therefore, the data density will not be sufficient in order to produce classical climate reconstructions with the use of indices only for this area.

Nonetheless, the narrative sources can provide exact dating – given that dating errors are carefully eliminated, for even contemporary chroniclers are sometimes inaccurate in that regard. These exact dates clearly represent an advantage compared to other methods of climate reconstruction. In addition, unlike reconstructions based on natural archives, the narrative sources can provide information on societal impacts.

Furthermore, the assumption of societal teleconnections[94] between the weather conditions, the output of agricultural production, food availability, and demographic development in the area of Switzerland offers the possibility of combining the results of reconstructions derived from natural archives with the written records. In the case of the Great Famine, this means that when the sparse famine descriptions of Basel, Geneva, and Colmar are linked to the results of reconstructions based on tree-ring data and varved lake sediments, a considerable probability is shown of large areas of today's Switzerland having suffered from wet and cold weather conditions during the summers in question and possibly also endured crop failures like other European areas. In this case, it seems likely that large parts of the population also suffered from famine.

In addition, the comparison between the descriptions in the narrative sources and reconstructions based on proxies from natural archives also shows that, in most cases, documentary data and natural proxies are consistent. This suggests that the narrative sources are highly reliable. The Swiss narrative sources of the fourteenth century obviously develop their full potential for historical climatology when compared to documentary sources of a broader area and to results from reconstructions based on natural archives.

94 See chapter 1 in this volume in regard to the societal teleconnections.

Marko Halonen

Hic aues incipiunt cantare: Shifts in the Beginning of Seasons in Medieval Calendars of Rome and the Nordic Countries

Abstract: Medieval calendars contain a great deal of information concerning not only liturgical feasts but also the movements of celestial objects, the beginning of seasons, and other natural phenomena. This case study analyzes approximately 500 Roman and Fenno-Scandinavian calendars with especial attention to their mention of seasonal conditions. This material reveals some general trends in the seasons' gradual shifts earlier or later in these calendars, depending on the century and location. The general pattern of these shifts gives some indication of how climatic and social changes of the fourteenth century became recorded in a practical tool for organizing time such as a calendar. Comparing these shifts at the opposite ends of Christendom also reveals how differently the same phenomena were perceived in different parts of the continent.

Keywords: calendars, seasons, Middle Ages, Rome, Nordic, Scandinavia, time

1 Introduction

During the Middle Ages,[1] Latin Christendom mostly relied on a Christian variant of the Julian calendar,[2] which had replaced the old Roman calendar by the order of

1 Although the Middle Ages can be defined in a multitude of ways, with starting points varying from the fourth to seventh centuries and ending points from the fourteenth to the seventeenth, in terms of calendars, the absolutely ground-breaking change occurred with the Gregorian calendar reform in 1582. However, the Nordic countries, which had become Lutheran in the course of the Reformation, did not initially adopt the Gregorian calendar. Therefore, this study considers sources for the entire sixteenth century. While this break might be seen as somewhat arbitrary or artificial, the turn of a new century probably did have some significance for the contemporaries, as well. The earliest surviving calendars are from the eleventh century, hence the early time limit.

2 The term "calendar" is used here in a broad sense to include all texts which are organized in calendar form, regardless of whether they are cataloged as *kalendarium, martyrologium, horarium, necrologium*, etc. What matters is the format: a medieval calendar derives from its ancient Roman origin in which the first day of the month is called *Kalendae*, which etymologically "calls" the other days of the month: that was the day when the priest declared the other important days of the month. Thus,

Marko Halonen, MA, Ph.D. candidate, University of Helsinki, General History, Faculty of Humanities, marko.halonen@helsinki.fi

Open Access. © 2020 Marko Halonen, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-004

Gaius Julius Caesar, then the high priest (*pontifex maximus*) of the Roman Empire, in 46 BC. The Julian calendar was based on calculations by the scholar Sosigenes, who assumed that a year was 365 days and six hours long – an overestimation of about eleven minutes.[3] As a result of this error, the Julian calendar lagged behind, and, with each progressing century, the spring equinox occurred approximately one day earlier. This ultimately lead Pope Gregory XIII to introduce a calendar reform in 1582, and this Gregorian reform can be seen as the ending point of the medieval period as far as the calendar is concerned.[4]

Medieval calendars inherited the structure of the Julian calendar both in terms of the year's length and the use of Latin language and Roman numerals. In addition, they incorporated many aspects which had probably already been obscure to the ancient Romans, including, for example, the Roman names of the months, a combination of deities such as *Ianus→Ianuarias* "January" and an illogical use of *September* ("seventh month") to *December* ("tenth month") for the last four months of a twelve-month year. Medieval calendars did not typically count days of the month according to the modern ascending order (e.g., January 1, January 2, etc.) but according to the Roman dating system based on a system of counting backwards from the marked days of *Kalendae, Nonae*, and *Idus* (e.g., January 2 would be *IV Nonas Januarias*). Yet a third peculiarity was the number of days in each month: February had twenty-eight days, but every four years, February 24 occurred twice. July and August had thirty-one days each, whereas otherwise a month of thirty-one days was always followed by a month with thirty days.

For some reason, medieval calendars have often been seen as synonymous with lists of saints, and many terms have developed accordingly, e.g., in German, *Heiligenkalender*, or in Finnish, *pyhimyskalenteri*. While saints are certainly a frequent element, medieval calendars also include a multitude of other information, such as other liturgical feasts, aspects dealing with *computus* (the calculation of the correct date for Easter), equinoxes and solstices, astronomical information, bad days (also known as "Egyptian days", bad for blood-letting and some other activities) and other references to apparently supernatural phenomena, and comments on local events, as well as information concerning the beginning of seasons,[5] which is the focus of

a calendar is a tool for organizing the days of the month and their tasks, which can in turn be related to saints, martyrs, prayers, the dead, or whatever, depending on the context for which the calendar was intended.

3 Robert Hannah, Time in Antiquity, London, New York 2009, p. 12.

4 Classic works on medieval calendars and time include e.g. Herman Grotefend, Zeitrechnung des deutschen Mittelalters und der Neuzeit, vols. 1–2, Hannover 1891–1892; Arno Borst, Zeit und Zahl in der Geschichte Europas, Berlin 1990; Arno Borst, Die karolingische Kalenderreform, Hannover 1998.

5 See on the aspect of seasons Grotefend (note 4), vol. 1, pp. 89–90, s.v. Jahreszeiten; Borst, Kalenderreform (note 4), 646–653; Arno Borst, Zeit und Zahl in der Geschichte Europas, Berlin 1990; Arno Borst, Nachträge, in: Id., Der Streit um den karolingischen Kalender, Hannover 2004, p. 193 s.v. Jahreszeiten.

this article. The existing scholarship on medieval calendars largely overlooks these aspects or mentions them only briefly. Yet these aspects are usually written in the calendars with the red, blue, or green ink that was used to mark only the most important saints and feasts.

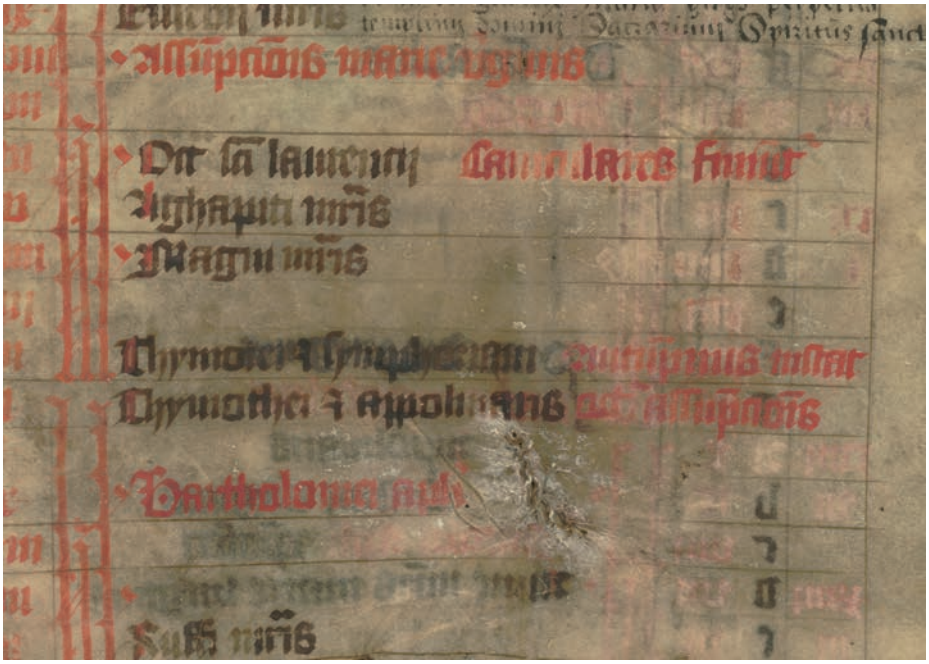

Figure 1: Notation for the month of August, where the beginning of autumn [*autumpnus instat*] is marked with red ink, as is the very important feast of the apostle St. Bartholomew (Finnish National Library F.m.VII.9. fol. 2v).

This is clearly visible in the image above (Figure 1), while other saints' days are marked with black ink. The beginning of seasons should thus be seen as essential information on par with the other aspects outlined above; the author of this calendar apparently thought of them as such.

2 Calendar Data and Methods

The first step in this study was the compilation of sources from the opposite ends of medieval Latin Christendom; these make up two distinct collections. The first

set is made of calendars determined[6] to be from Rome or its surroundings in Lazio.[7] A total of 111 versions[8] of medieval calendars were studied of which forty-six calendars – or nearly half of the Roman calendars studied[9] – mention at least

6 Localizing medieval calendars is an extremely difficult task. All of the commonly used methods are potentially problematic. The most common method is to identify local saints, who are known from other sources to have been venerated particularly strongly in a specific region. This approach is complicated by the fact that there is no comprehensive historical overview of medieval calendars. Calendars might not paint the same picture as other source groups, however, which means that localizing a calendar based on mention of a particular saint might end up being circular reasoning. Secondly, calendars can be localized using paleography, but this risks localizing the calendars according to the scribe, who may have moved from one region to another while keeping his native paleographical style. Thirdly, internal references inside the calendars – e.g., the dedications of particular churches or other local events – provide some indication of their origin. This method, however, includes the risk that calendars might have been copied from a foreign example, in which case also foreign "local" events are copied into calendars actually used in a totally different region. The fourth option is codicology, meaning the physical aspects of the manuscript such as ink, parchment, binding etc., but often manuscripts were produced and used in very different places.

7 For the latest list of Italian medieval calendars, see Giacomo Baroffio, Kalendaria Italica. Inventario, in: Aevum. Rassegna di scienze storiche linguistiche e filologiche, 77/2 (2003), pp. 449–472. The catalogs of the *Biblioteca Apostolica Vaticana* as well as *Biblioteca Angelica* have also been used in localizing the calendars. I am grateful to my colleagues for their assistance in pointing out Roman calendars as part of the ongoing research project concerning time in medieval Rome, *Institutum Romanun Finlandiae*.

8 Calendars, like many other medieval texts, often contain later additions and alterations. These alterations can sometimes very dramatically change the inner meaning of the calendar, if, for example, a whole new cycle of time is added, such as the seasons or zodiac signs. If a calendar includes later additions, it means that the calendar was certainly used by someone who, on the other hand, considered the changes necessary, but also, on the other hand, considered the original calendar sufficiently reliable to be used as a basis for the new changes. These changes were sometimes made decades, or even centuries later; in such cases, they can reveal a great deal about the author's preferences as well as the use of tools like calendars developed over time. This is why each altered version of a calendar is analyzed separately, even if this might be considered as "doubling" the material.

9 The Roman calendars which refer to seasons (calendars which contain later additions and have thus been included in two calendar versions are marked with an underscore and number (e.g. _2): London, British Library, Add MS 30034; London, British Library, Add MS 30034_2; Munich, Bayerische Staatsbibliothek, BSB-Ink M-459; Paris, Bibliothéque nationale de France, Latin 826; Paris, Bibliothéque nationale de France, Latin 826_2; Rome, Biblioteca Angelica, Z.14.10/1; Rome, Biblioteca Angelica, MSS. 1098; Rome, Biblioteca Angelica, MSS. 24; Rome, Biblioteca Angelica, MSS. 24_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroA9; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroA9_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB67; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB67_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB69; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB72; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB72_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB79; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB79_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB84; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB84_2; Vatican City, Biblioteca Apostolica Vaticana,

one of the seasons. The average date[10] of this set is 1366, with the oldest calendar dated to around 1071 and the most recent to 1551.

The other data set is based on Nordic[11] sources: 428 calendar versions were studied, but references to seasons were much rarer than in the Roman sources. Only forty-six of the Nordic calendars referred to a season – just over ten percent.[12] This could well be the result of the fact – discussed at great length later in this essay –

ArchCapSPietroB87; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB87_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB88;

Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroB88_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroD156; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroD156_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroE14; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroE14_2; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroE4; Vatican City, Biblioteca Apostolica Vaticana, ArchCapSPietroH28; Vatican City, Biblioteca Apostolica Vaticana, Barb.lat.609; Vatican City, Biblioteca Apostolica Vaticana, Chig.C.VI.174; Vatican City, Biblioteca Apostolica Vaticana, S Maria Maggiore 97; Vatican City, Biblioteca Apostolica Vaticana, S Maria Maggiore 97_2; Vatican City, Biblioteca Apostolica Vaticana, S.Maria.Magg.105 (INC); Vatican City, Biblioteca Apostolica Vaticana, S.Maria.Magg.105 (INC)_2; Vatican City, Biblioteca Apostolica Vaticana, S.Maria.Magg.106; Vatican City, Biblioteca Apostolica Vaticana, SMariaMaggiore119; Vatican City, Biblioteca Apostolica Vaticana, SMariaMaggiore120; Vatican City, Biblioteca Apostolica Vaticana, Vat.lat. 4406; Vatican City, Biblioteca Apostolica Vaticana, Vat.lat. 4406_2; Vatican City, Biblioteca Apostolica Vaticana, Vat.lat.12986; Vatican City, Biblioteca Apostolica Vaticana, Vat.lat.12986_2; Vatican City, Biblioteca Apostolica Vaticana, Vat.lat.12986_3; Vatican City, Biblioteca Apostolica Vaticana, Vat.lat.12988; Vatican City, Biblioteca Apostolica Vaticana, Vat.lat.14701.

10 As with localization, dating medieval manuscripts is difficult, although in the case of calendars perhaps a bit less problematic. Usually four methods are used: paleographic, codicological, hagiographic (saints whose lifetime or date of canonization is known), and internal comments found in the calendars. The dating used in this article is based on the information given in the catalogs of the libraries and archives holding the manuscripts. In the case of multiple dates, an average is used.

11 The term Nordic refers nowadays to the Nordic countries (Denmark, Finland, Iceland, Norway, Sweden), but the term is also surprisingly suitable for the Middle Ages for two reasons. At the political level, three kingdoms merged in the late Middle Ages to form a kingdom called the Kalmar Union, which included the territories of all of the abovementioned modern Nordic countries and lasted from the late fourteenth century into the early sixteenth century. Secondly, at the ecclesiastical level, the same three kingdoms which formed the Kalmar Union in 1389 formed a single church province between 1104 and 1152 under the archbishopric of Lund (then in Denmark, now in Sweden). Even when the archbishopric was divided into three church provinces of Denmark (under Lund), Norway (including Iceland) (Nidaros) and Sweden (including Finland) (Uppsala) between 1152 and 1164, these provinces remained largely unchanged throughout the period.

12 The Nordic calendars that refer to seasons are:
Colbatzkalendariet, in: Erik Kroman (ed.), Corpus codicum danicorum medii aevi Vol. V Scriptores rerum danicarum, altera pars. Annales, Copenhagen 1965; Colbatzkalendariet_2, in: Erik Kroman (ed.), Corpus codicum danicorum medii aevi Vol. V Scriptores rerum danicarum, altera pars. Annales, Copenhagen 1965; Copenhagen, Det Kongelige Bibliotek, E don var 23 4o; Copenhagen, Det Kongelige Bibliotek, NKS 203 8:o;

Copenhagen, Det Kongelige Bibliotek, GKS 3260 4to; Copenhagen, Det Kongelige Bibliotek, GKS 3260 4to_2; Copenhagen, Det Kongelige Bibliotek, LN 179 Storfol. (fot)/LN 179 2°, 4 eks; Helsinki,

that many authors considered the beginning of the seasons to be firmly established. Perhaps Scandinavian authors viewed it as problematic to assign any of the common starting dates to the seasons in the Nordic calendars; the seasons were obviously very different in Rome than in Scandinavia. However, as will be discussed below, the Scandinavians apparently did adapt the common Christian calendar for their purposes, imparting local meaning to the different events. The average date of this set is 1370; the oldest calendar version dates to around 1100 and the most recent to 1591.

The two data sets are thus fairly similar in terms of the average age of the calendars. However, as Table 1 below demonstrates, the Roman set is heavily focused on the fourteenth and fifteenth centuries whereas in the Nordic set the thirteenth and sixteenth centuries are the most frequently represented:

Table 1: Number of calendars by century.

Century	Calendars in the Nordic set	Calendars in the Roman set
11th	0	1
12th	4	3
13th	13	5
14th	9	17
15th	7	18
16th	13	2
TOTAL	46	46

Helsingin yliopiston almanakkatoimisto, Möllman, Een Bönebook ock Calendarium 1590; Helsinki, Kansalliskirjasto, MD 706 I 14;

Helsinki, Kansalliskirjasto, Rucouskiria Bibliasta, Rv Hartauskirjallisuus Agricola; Helsinki, Kansalliskirjasto, Aö II 12_3; Helsinki, Kansalliskirjasto, C IV 21; Helsinki, Kansalliskirjasto, C IV 21_2;; Helsinki, Kansalliskirjasto, F.m.VII.10; Helsinki, Kansalliskirjasto, F.m.VII.10_2; Helsinki, Kansalliskirjasto, F.m.VII.9; Oslo, Norsk Riksarkiv, Lf 145; Oslo, Norsk Riksarkiv, Lf 145_2; Reykjavik, Stofnun Árna Magnússonar í íslenskum fræðum, Am 249 o fol; Reykjavik, Stofnun Árna Magnússonar í íslenskum fræðum, GKS 1812 III 4to; Reykjavik, Stofnun Árna Magnússonar í íslenskum fræðum, GKS 1812 III 4to _2; Stockholm, Kungliga biblioteket, B 172_3; Stockholm, Kungliga biblioteket, F1700 510;; Stockholm, Kungliga biblioteket, Inkunabel 267; Stockholm, Kungliga biblioteket, Inkunabel 722_2; Stockholm, Kungliga biblioteket, Isl perg 4o 28; Stockholm, Kungliga biblioteket, Isl perg 4o 28 _2; Stockholm, Kungliga biblioteket, X 767; Stockholm, Kungliga biblioteket, X 767_2; Stockholm, Riksarkivet, Fr 2547; Stockholm, Riksarkivet, Fr 2547_2; Stockholm, Riksarkivet, Fr 25548; Stockholm, Riksarkivet, Fr 25548_2; Stockholm, Riksarkivet, Fr 25627; Stockholm, Riksarkivet, Fr 25628; Stockholm, Riksarkivet, Fr 25628_2; Stockholm, Riksarkivet, Fr 25637; Stockholm, Riksarkivet, Fr 25637_2; Stockholm, Riksarkivet, Fr 25638; Stockholm, Riksarkivet, Fr 25981/Fr 25983; Stockholm, Riksarkivet, Fr 25981/Fr 25983_2; Stockholm, Riksarkivet, Fr 6647; Stockholm, Riksarkivet, Fr 6647_2; Stockholm, Riksarkivet, Fr 6647_3; Uppsala, Uppsala Universitetsbibliotek, C447; Uppsala, Uppsala Universitetsbibliotek, E44.

The calendars analyzed in this article contain four types of references to seasons. The first of these is the simplest: mentioning that a certain season begins on a particular day.[13] A second type of reference is a verse somewhere within the calendar which links the beginning of a season to a particular feast, like the feast of St. Urban in the case of summer: 'Urban drives spring away.'[14] These two types of reference are grouped together in this study because both suggest a certain date for the beginning of a season, albeit in slightly different ways.

In the diagram below, each season in the two data sets is analyzed using a scattered x-y diagram to visualize the development of seasonal starting dates from the eleventh to the sixteenth century. In all of the diagrams, the x-axis represents a timeline of the centuries in question and the y-axis the month and the day (e.g., 2,08=February 8; 2,22=February 22, etc.) when the season in question starts.

A third form of reference to the seasons relies on mention of natural phenomena that can be linked to the beginning of a particular season, such as birds starting to sing.[15] These references only implicitly refer to season change, but, on the other hand, they are more informative about actual natural phenomena. These are used as supplementary evidence.

A caveat concerning the sources, and their references to the seasons in particular, must be added here: the vast majority of medieval calendars have been lost. One can reasonably assume that there was at least one calendar in use in each church or other religious institution (such as a monastery or convent), because calendars are such useful tools for organizing time. For the Nordic countries included in this study, for example, there were an estimated 6,000+ churches in the area, in addition to some 250 monasteries and convents, and many individuals possessed calendars as well.[16] Yet only slightly over 400 calendars are extant, meaning that less than ten percent of the entire material has survived to the twenty-first century. Given the considerable variation, however, between the starting dates of the seasons and the broad geographical and chronological distribution of the surviving sample, the surviving sources do provide a good representative sample.

13 Three structures are used in this: 1) *Veris initium* 2) *Ver oritur* 3) *Ver nova/adultum/praeceps*.

14 *Ver fugat Urbani*. Stockholm, Riksarkivet. Fr 25628.fol.1r.

15 *Hic aues incipiunt cantare*. Vatican City, Biblioteca Apostolica Vaticana. Arch. Cap. S. Pietro. H.28. fol. 2r.

16 Estimates on churches are based on Markus Hiekkanen's excellent analysis of the medieval churches in Finland in which he also gives estimates of the situation in the other Nordic countries (Markus Hiekkanen, Suomen keskiajan kivikirkot, Helsinki 2007). The estimates of religious organizations are based on the calculations of the author which are derived from a multitude of sources that deal with the different parts of the Nordic; no overall work concerning Nordic religious orders exists.

3 Analysis

As Table 2 below shows, seasonal starting dates vary across both data sets[17]:

Table 2: Starting dates of seasons.

Season	Starting dates in the Roman data	Starting dates in the Nordic data
Spring	Feb 7, Feb 22, Feb 24, Feb 25	Feb 4, Feb 7, Feb 20, Feb 21, Feb 22, Feb 23
Summer	May 9, May 24, May 25, May 26	Apr 14, May 7, May 8, May 18, May 23, May 24, May 25
Fall	Aug 7, Aug 22, Aug 23	Aug 21, Aug 22, Aug 23, Aug 24
Winter	Nov 7, Nov 22, Nov 23, Nov 24	Oct 13, Oct 14, Nov 8, Nov 23, Nov 24

Overall, the Nordic material has more variety in each of the seasons than the Roman. This might seem surprising because the beginning dates are relatively rare in the Nordic calendars compared to the Romans, but, on the other hand, the variety might the result of the very different climate that Scandinavia had and has compared to Central Italy.

The biggest differences between the sets are in the beginning of summer, which in the Roman data is never earlier than May 9, whereas in the Nordic data the earliest starting date is April 14.[18] This seems, at first hand, quite counterintuitive: one might well expect to see an earlier date for summer in the case of Rome, which certainly had a warmer climate than Scandinavia in medieval times. However, meaningful analysis must consider certain important aspects concerning the historical context of the starting dates of the seasons, as well. The beginning dates of seasons were an interesting topic for many of the authors who were popular in the Middle Ages, including Bede (Beda Venerabilis), who in the eighth century wrote the ground-breaking work on time 'De Temporum Ratione'. He mentions, in a somewhat enigmatic style, that Isidore of Seville's starting dates for the seasons are very late (February 22, May 24, August 23, November 22), whereas the more reliable Greeks and Romans preferred earlier dates (February 7, May 9, August 7, November 7).[19] Clearly by the eight century, there were already two different traditions within Christendom, and there is always a

17 Because the Julian calendar that was used in Imperial Rome as well as the Christian Church was about 11 minutes too long, in about 130 years a whole 'extra' day appears compared to the calendar which gradually lacks behind. Because of this the calendar was about 11 days behind be the beginning of the 16th century. This should be taken into account when analyzing the starting dates of the seasons as well, but on the other hand it is very difficult to say whether or not the error was noticed by the maker of the calendar.

18 Uppsala, Uppsala Universitetsbibliotek, E 44; Stockholm, Kungliga biblioteket, Isl. perg. 4o 28; Copenhagen, Det Kongelige Bibliotek, NKS 203 8o.

19 Beda Venerabilis, De Temporum ratione, ed. Faith Wallace. Liverpool 1988, Repr. Liverpool 2004, pp. 100–103. Bede explicitly mentions Pliny the Elder's *Naturalis Historia*, but ironically Pliny's dates

danger that a calendar's creator might have defined the beginning of seasons according to two rival "authoritative" main options, resulting in a later or earlier start of the seasons.

But this does not render a study of the starting dates of the calendars pointless. Even though a certain firmly established custom existed concerning the starting dates (or actually two), these are not the only options found in medieval calendars – neither in those from Rome nor from the Nordic regions (see Table 2). Even if the maker of a calendar was merely following a date which came from previous important authors such as Bede, he had to choose between the two main themes (or possibly a third option), and this decision could have been affected by how relevant it seemed to mention that spring begins at the beginning or end of February, for example. Particularly revealing are those cases in which the original calendar did not contain information concerning the seasons, but a later user added such information.[20]

Furthermore, it is difficult to say which way the cause and effect relationship worked in the case of the "authoritative" starting dates of the seasons. The early date of summer in the Nordic context could in fact be related to a pre-Christian Scandinavian tradition which divided the year in mid-April and mid-October into two halves: summer and winter. This tradition was particularly significant in medieval Iceland,[21] but a similar pattern is found on the other side of the Nordic region in Finland: the feast of St. Calixtus (October 14) was the traditional day for ending work on the fields.[22] The feast of St. Martin (November 11) was traditionally seen as the ending point of the agrarian year in general, whereas the feast of St. Catherine (November 25) was the day when sheep were slaughtered, and a sheep's head was eaten, also ending a cycle, this time with livestock.[23] Therefore all three options for the starting date of winter (mid-October, early November, late November) can actually be linked to both events of the agrarian year and to the Christian liturgical year. Bede and other authors were probably just as much affected by the agrarian as the Christian year, which brings us back to the relevance of the starting dates of the seasons: they reveal much about the local agrarian year, which in turn depends on local climatic conditions.

The Roman data set gives interesting results in terms of the beginning of spring (Figure 2). The early option (February 7) occurs several times before 1257. During this period, there is only one case where a later date, February 22, is given (in 1163). After 1257, however, all the dates for the beginning of spring are February 22 or later, which

---

are different, and less logical: Feb 8; May 10; autumn equinox [i. e. around Sep 24 in those days]; and Nov 11.

20 E.g. Stockholm, Kungliga biblioteket, B172.

21 Kirsten Hastrup, Culture and History in Medieval Iceland. An anthropological analysis of structure and change, Oxford 1985, pp. 25–26.

22 Kustaa Vilkuna, Vuotuinen ajantieto [Annual Knowledge Concerning Time], Helsinki 1995.

23 Risto Pulkkinen, Suomalainen kansanusko. Samaaneista saunatonttuihin [The Finnish folk religion. From shamans to sauna elves.], Helsinki 2014.

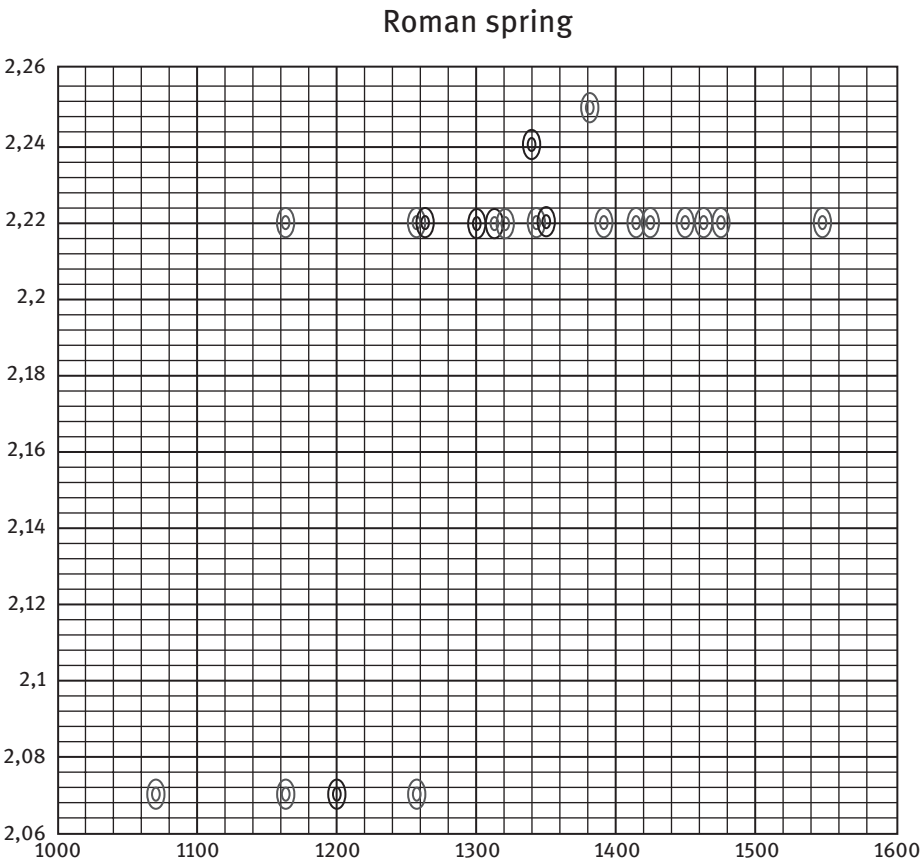

Figure 2: Roman Spring. Diagram by the author.

seems to indicate that spring was perceived to arrive later during the fourteenth and fifteenth centuries than during the earlier centuries.

This is perhaps supported further by a notation in one eleventh-century Roman calendar on February 13, 'Here birds start to sing,'[24] which seems to indicate that whoever made the calendar, or perhaps copied it from an earlier version, probably also felt that certain signs of spring were also apparent in nature. In this particular calendar, the start of spring is mentioned explicitly a few days earlier (February 7). This might indicate that the 'true' spring had already moved a few days later at this point, and thus the entry on February 7 was based on an earlier example.

24 "Hic aues incipiunt cantare". Vatican City, Biblioteca Apostolica Vaticana, Arch. Cap. S. Pietro. H.28, fol. 2r. This comment, as well as the starting dates of the seasons might of course also be copied from an earlier author, but even in that case the copyist made the choice of including the comment, and all the users decided not to comment on the comment or erase it.

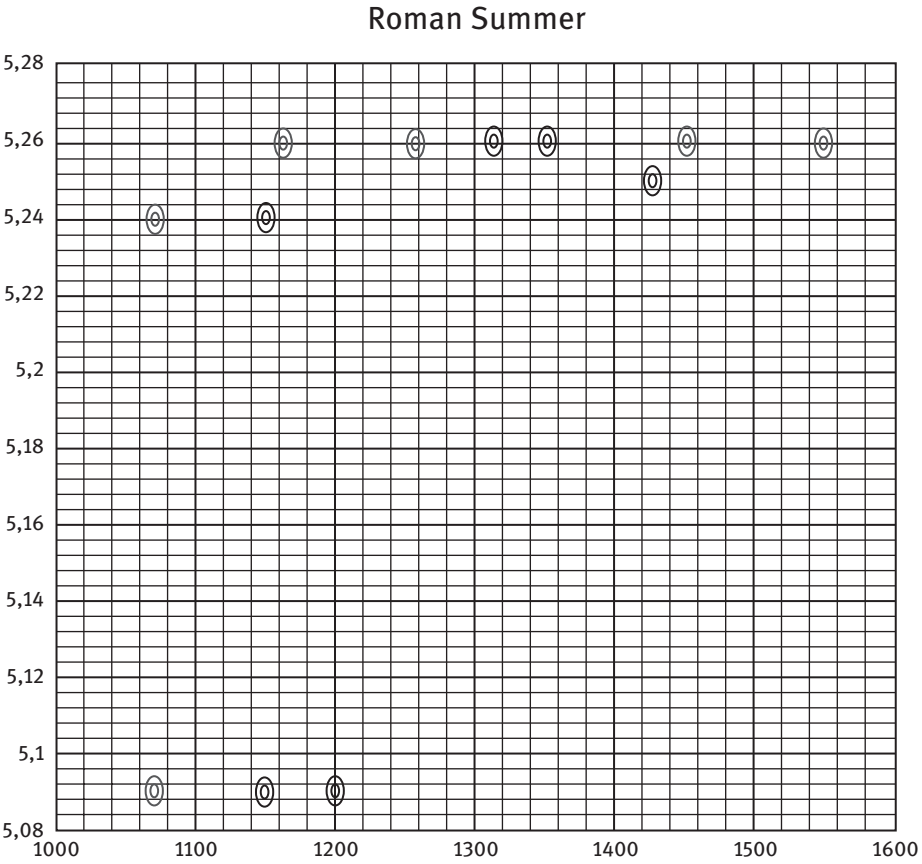

Figure 3: Roman Summer. Diagram by the author.

The beginning of summer (Figure 3) shows a very similar pattern in the Roman data: the early dates for the beginning of summer (May 8, May 9) disappear completely after 1200. Since the later dates of May 24 and May 26 are also found in the twelfth century, the results seem to imply that the twelfth-century calendars which include the early beginning of summer (May 8 or May 9) might have been copied from earlier calendars, in which that date was still more prevalent, whereas the later summer starting dates were added in the twelfth century. Indeed, in the temperature proxy records from Southern Europe compiled by Fredrik Charpentier Ljungqvist, the warmest period seems to have been around the year 1000.[25]

25 Fredrik Charpentier Ljungqvist, Temperature Proxy Records Covering the Last Two Millennia. A Tabular and Visual Overview, in: Geografiska Annaler, Series A, Physical Geography, vol. 91, no. 1 (2009), p. 19.

Since both spring and summer clearly shifted, it seems possible to assume that these two seasons that are so fundamental for the agrarian cycle indeed did begin later starting from the middle of the thirteenth century, and this change is clearly reflected in the calendars. It seems rather unlikely that this could be a coincidence.

The pattern for Roman dating of fall (Figure 4) is not as clear as for spring and summer. Both an early date of August 8 and later ones (August 22, August 23) can be found in the calendars from the eleventh to the fifteenth centuries. Still, the late date for fall does disappear after 1450, and there is a heavy concentration of calendars which have the early date of August 7 between the years 1475 to 1482, during which the climate probably was colder than in the earlier centuries. It would be tempting to assume that the late date for autumn "lingered" until authors recognized it as clearly too late and adopted an earlier date in all the new calendars produced in the latter half of the fifteenth century.

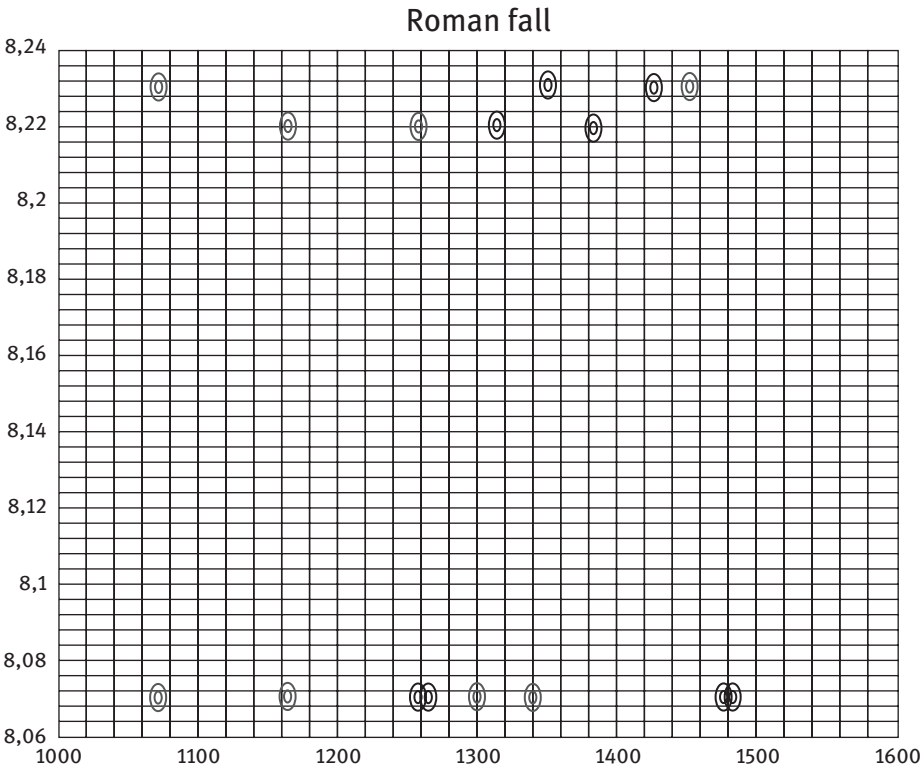

Figure 4: Roman Autumn. Diagram by the author.

A possibility also worth considering is that changes in temperature and precipitation are more easily observable in spring and fall. In the context of Rome, the arrival of spring was probably linked to at least diminishing rainfall, increasing

sunshine, rising temperatures, new leaves on deciduous plants, and various agrarian tasks. In the case of fall, the question is more about the harvest, which naturally depends on the summer, as well, not simply about when the weather changes. Fall in central Italy is often quite warm today compared to spring. If this was the case in the Middle Ages, as well, it would have made the "start" of fall more difficult to pinpoint.

It is most difficult to discern a pattern in the Roman dating of winter (Figure 5): the early starting dates only occur in the eleventh and thirteenth centuries and after that there is no major change in the date. Nevertheless, the calendars that contain the eleventh and thirteenth century early dates for winter are somewhat problematic. The eleventh-century calendar actually contains two dates for both summer and fall: May 9/May 24; August 7/August 23. Therefore it is possible that the author of the calendar did consider two options (perhaps one of which seemed more relevant than the other) but ended up putting them both.

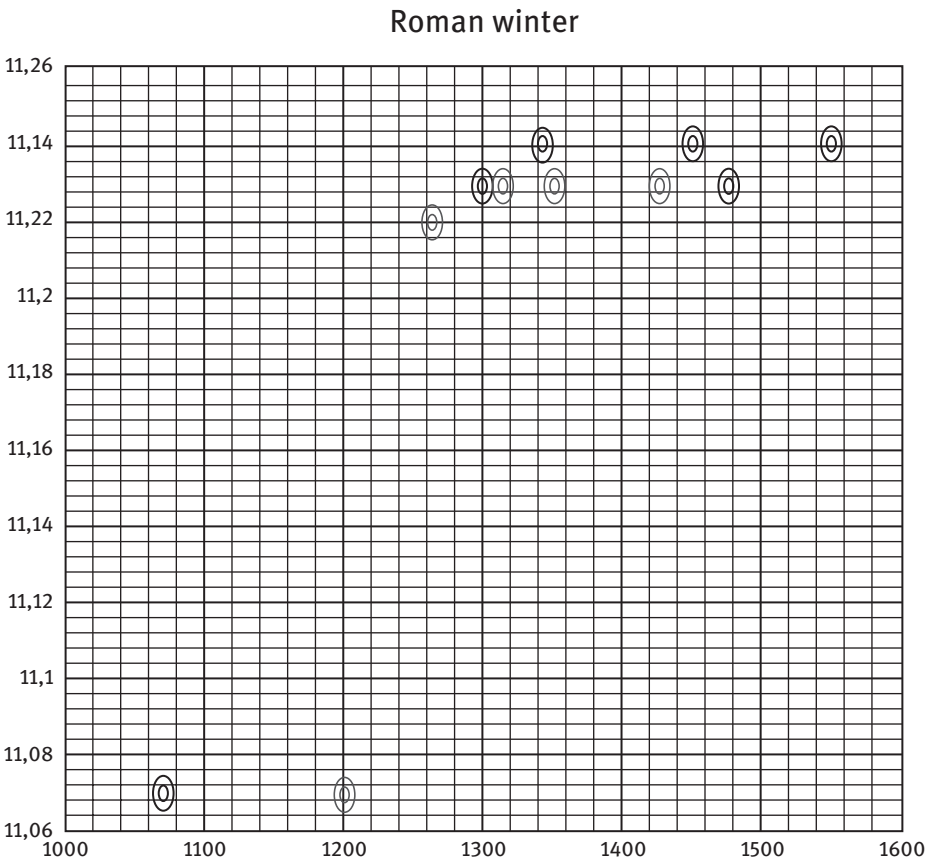

Figure 5: Roman Winter. Diagram by the author.

The two calendars dated to ca. 1200 contain very early dates for all of the seasons (spring, February 7; summer, May 5; fall, August 8; winter, November 7). This casts doubt on the results' being an actual reflection of experienced climatic conditions; it seems instead that, in this case, the seasons represented a simple division of the year into four more or less equal parts, as was discussed above. Also, the same difficulty of determining winter compared to fall in the Roman context (where snow or frost can hardly be used as an indicator) might have something to do with this.

In the case of spring in the Nordic data set (Figure 6), there are six options for the beginning of spring (see Table 2 above) that form a clear pattern of change over time. The earliest option for spring, February 7, appears twice in 1150 and once in 1225 and then disappears completely until 1438. Meanwhile the later options, February 22 and 23, dominate the entire fourteenth century. This points towards the hypothesis that spring was at least considered to be arriving later in the fourteenth century than in the twelfth or thirteenth.

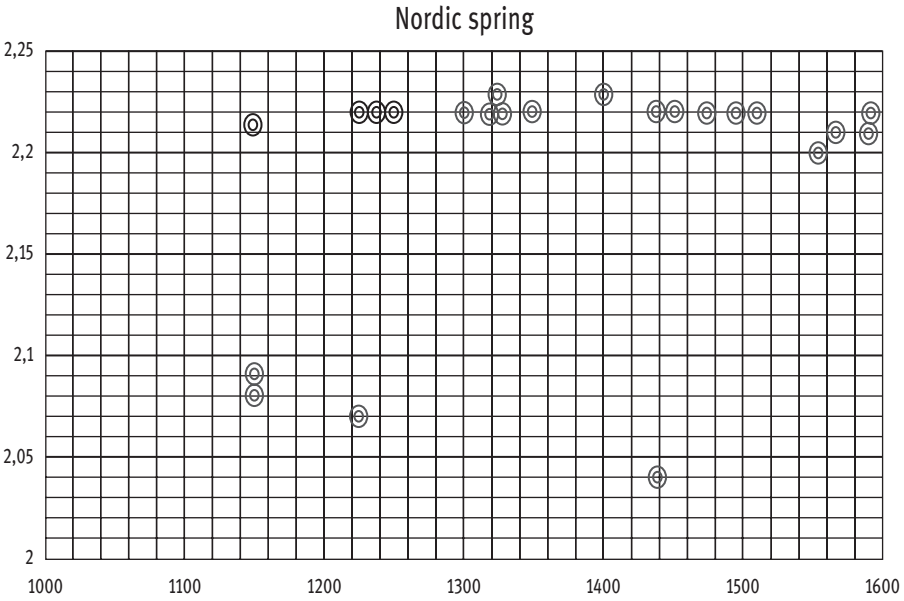

Figure 6: Nordic Spring. Diagram by the author.

The change seems to come a bit earlier than in Rome: whereas this transition could be found in Roman sources in the early fourteenth century, Nordic calendars had already implemented the later dates in the early thirteenth century. Indeed, out of the seventeen temperature proxy records from the Nordic countries compiled by Fredrik Charpentier Ljungqvist, fourteen place the greatest drop in

temperatures in the twelfth century or earlier and only three in the thirteenth or fourteenth century.[26]

There is a similar, although not identical pattern in the case of summer (Figure 7). In the twelfth and thirteenth centuries, May 7 is still relatively common, but it then disappears completely (except for one individual case in 1328) until the late sixteenth century. During most of the fourteenth and the entire fifteenth century, the only dates suggested for the start of summer are May 23, 24, or 25.

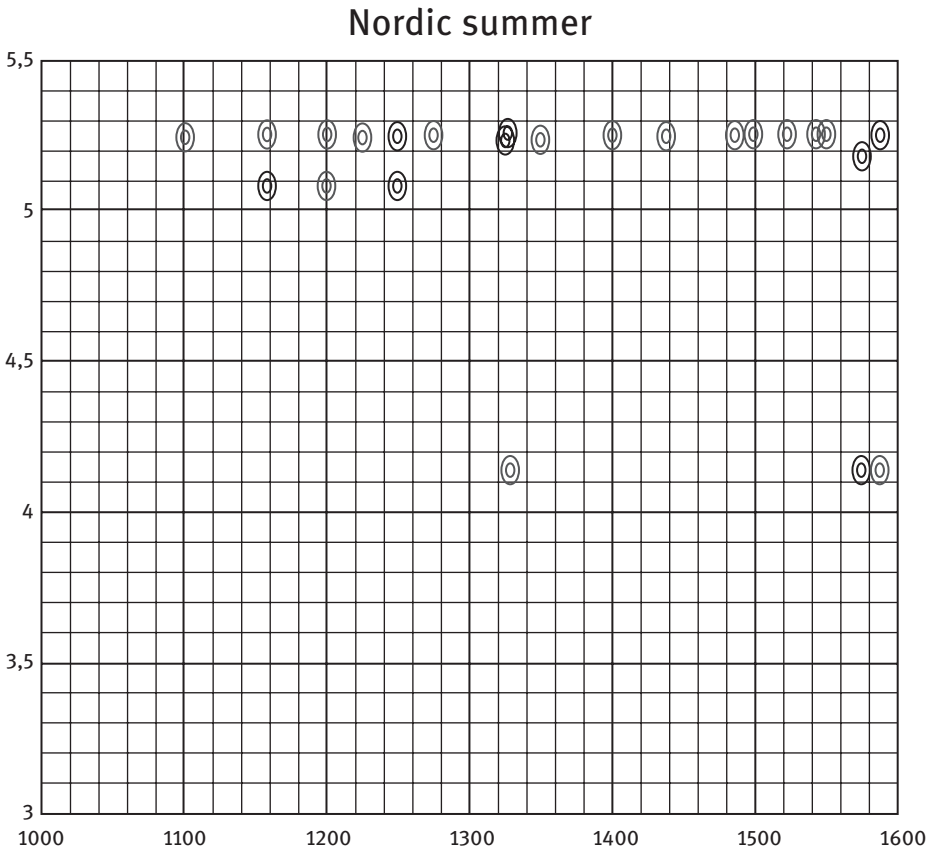

Figure 7: Nordic Summer. Diagram by the author.

Likewise, in the case of summer, the great shift in the pattern seems to occur already in mid-thirteenth century, although this depends in part on whether one interprets the individual entry of April 14 from 1328 as an exception. The latter case would be

26 Charpentier Ljungqvist (note 25), pp. 18–19.

closer to the situation in Rome, but since it is a rather isolated example, both in terms of its date and year, it should perhaps indeed be considered an exception.

The earliest date for fall (Figure 8), August 21, does not occur in the twelfth or thirteenth centuries, but only in 1328 and 1450, which mirrors the pattern for spring and summer. In terms of years, the change is closer to what was seen in the case of spring and summer in the Roman data, although there (as we have seen above), the pattern for fall was a bit different.

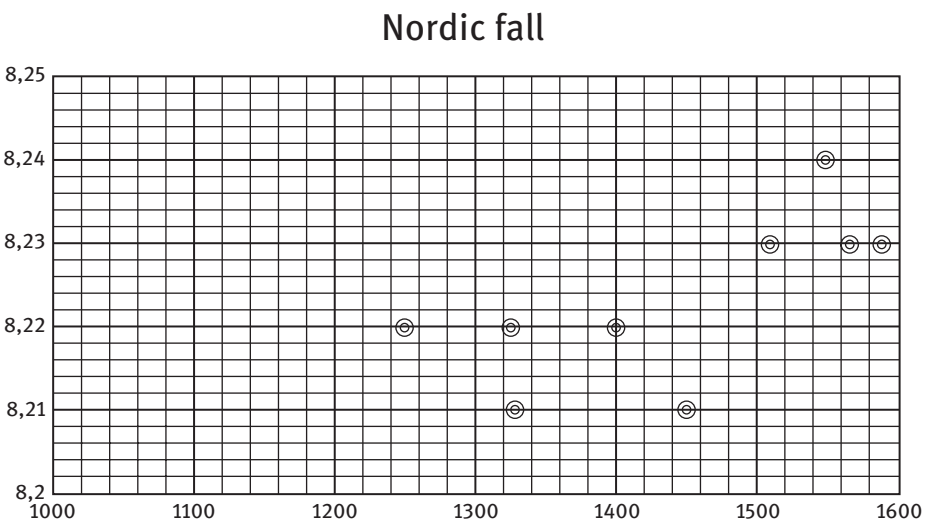

Figure 8: Nordic Autumn. Diagram by the author.

However, in the Nordic data, the latest dates for fall are actually found in the sixteenth century. This is slightly surprising, but it might also reflect the pattern Håkan Grudd worked out in an analysis of Lake Torneträsk in Sweden, which points towards a slightly warmer period from approximately 1400–1600.[27] There is also a very early starting date (August 21) for fall in a calendar dating to 1450. This confirms Jan Esper's observations based on maximum latewood density (MXD) chronology: there was a drop of about three degrees Celsius in 1453 in the Nordic region.[28]

The only date given for the beginning of winter (Figure 9) during the twelfth and thirteenth centuries is November 23. The first instance of an earlier date (November 8)

27 Håkan Grupp, Torneträsk tree-ring width and density AD 500–2004. A test of climatic sensitivity and a new 1500-year reconstruction of north Fennoscandian summers, in: Climate Dynamics 31 (2008), pp. 843–857.

28 Jan Esper, Northern Hemisphere temperature anomalies during the 1450s period of ambiguous volcanic forcing, in: Bulletin of Volcanology 79/6 (2017), pp. 1–9.

is in 1300, and a very early instance (October 14) occurs for the first time in 1328. In the Nordic region, however, some sixteenth century calendars indicate very early dates for winter in the sixteenth century, which somewhat contradicts the data concerning fall above.

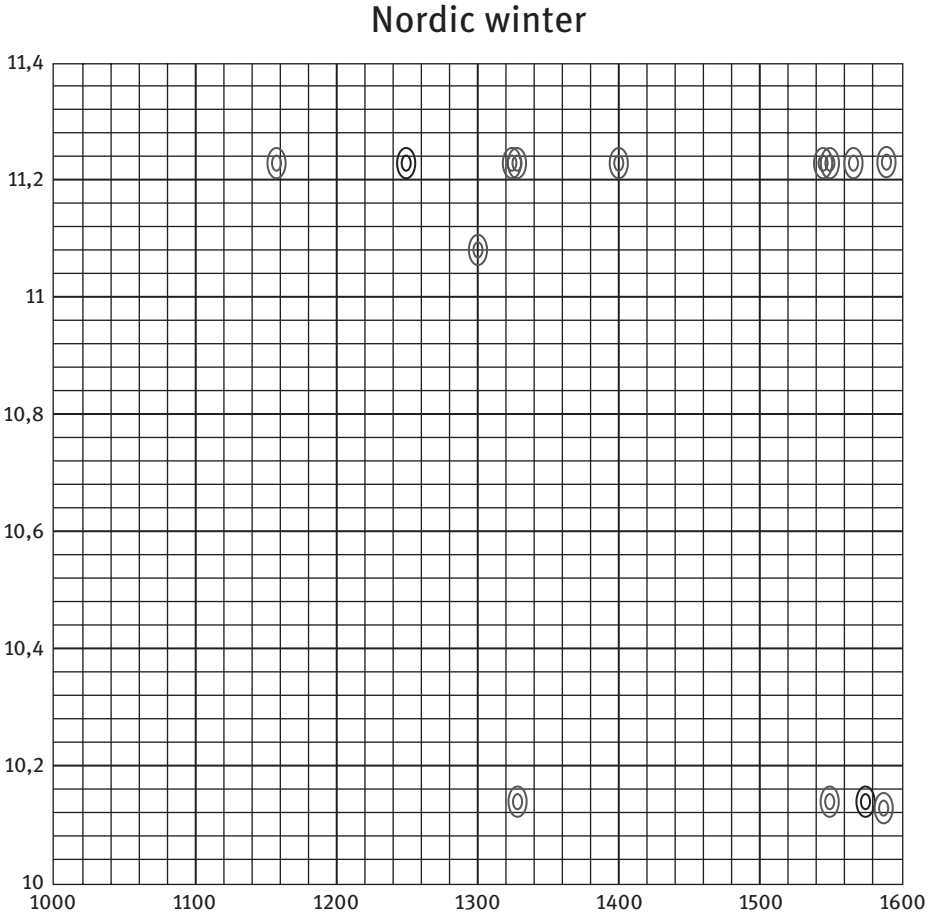

Figure 9: Nordic Winter. Diagram by the author.

In general, the dates of the seasons in the Nordic context correlate rather well to the pattern known from other sources, namely, that in Scandinavia the warmest period in the Middle Ages was between 900 and 1100, during which average temperatures were close to what they were in the 1990s, but summers were somewhat warmer in the northern parts of the region, and winters in the eastern parts (Finland) somewhat

milder.[29] This was followed by a slightly colder period until the end of the twelfth century, when the climate warmed once again; climatic conditions because more unstable in the thirteenth century, and a clearly colder period finally started around 1300.[30] As Fredrik Charpentier Ljungqvist's analysis of temperature proxy records suggests, however, there is evidence of considerable variation within Scandinavia.[31]

4 Conclusions

Both the Roman and the Nordic data sets show clear patterns of change over time concerning the seasons. In the Roman set, the beginning of both spring and summer clearly shifted later starting in the fourteenth century. A very similar but earlier shift occurs in the Nordic data by the mid-thirteenth century.

A pattern similar to that found in the Roman data for spring and summer can be seen in the Nordic data for fall and winter: starting dates seems to move earlier starting from the fourteenth century. In the Roman data, fall and winter do not give as clear a pattern as this, but this might be partly due to the problematic nature of the calendars in question.

Overall, the change in the beginning of seasons that has been demonstrated by scientific research can be confirmed in medieval calendars, as well. This is particularly the case with spring and summer, both of which demonstrate a very clear pattern of change in both of the data sets. Although the beginning dates of the seasons were to a certain extent predetermined by ancient and early medieval authors, every compiler of a calendar had to choose which of the many possible dates should be followed. It seems very plausible that this decision was affected by the contemporary climatic circumstances. Also, as we have seen, the patterns of change in the dating of the seasons seem to correlate with the changes scientists have observed with other methods, as well. Further comparative research on the situation in Central and Eastern Europe, the British Isles, and southern Europe would help scholars to see the broader picture and collect additional evidence to back up these conclusions.

29 Fredrik Charpentier Ljungqvist, Den medeltida värmeperioden i Skandinavien, in: Dick Harrison (ed.), Sveriges historia 600–1350, Norstedts, Stockholm 2009, p. 147.

30 Charpentier Ljungqvist (note 27), p. 148.

31 Charpentier Ljungqvist (note 23), pp. 18–19.

Heli Huhtamaa

Climate and the Crises of the Early Fourteenth Century in Northeastern Europe

Abstract: This article demonstrates how tree-ring material can be applied to historical research using the climate-driven crises of the fourteenth century as a case study. Medieval northeastern Europe is a promising case study for such a purpose, because climate-sensitive tree-ring data are readily available for this period and region. Whereas large areas of western Europe were affected by continuous heavy rains and bitter winters during the 1310s, this dendrochronological evidence suggests that northeastern Europe was not. Favorable climatic conditions prevailed in northeastern Europe in the late 1310s, and, more generally speaking, during the first half of the fourteenth century, as well. The juxtaposition of this new information from tree-ring analyses with the established understanding of the development of the region challenges the view that the crises of the fourteenth century reached the northeasternmost corner of Europe. The case study demonstrates how teleconnections of climate and society, like the crises of the early fourteenth century, can materialize on a societal level very different ways in different locations.

Keywords: Climate, The Great Famine of 1315, Novgorod, Finland, Russia, Tree Rings, Medieval Agriculture, Food System Resilience

1 Introduction

Medievalists are increasingly addressing topics of climate history. Studies on past human responses to variations in climate have arguably never been more needed than in the present context of ongoing anthropogenic climate change. Using written sources – for example chronicle records of different weather and climate-related phenomena – historians can reconstruct past variations of climate and weather and their impacts on society, which contributes to understanding of current climatic variations.[1] Written source material, however, for such detailed information from the pre-modern era is available only for limited areas. As an alternative, climate-sensitive natural data, so-called proxy data, allow to detect past climate variability where written sources are not available. Climate and weather anomalies can be reconstructed, for example, from

1 Rudolf Brázdil et al., Historical climatology in Europe. State of the art, in: Climatic Change 70 (2005), pp. 363–430.

Dr. Heli Huhtamaa, University of Bern, Institute of History and the Oeschger Centre for Climate Change Research, Länggassstrasse 49, 3012 Bern, Switzerland, heli.huhtamaa@hist.unibe.ch

Open Access. © 2020 Heli Huhtamaa, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-005

study of tree rings, ice cores, and speleothems.[2] Recent decades have witnessed a notable increase in the number, sophistication, and accessibility of such climate reconstructions, and entirely new archives have opened for medievalists. In particular, tree-ring based reconstructions have become an invaluable resource for historians of pre-modern times who aim to detect the impacts of past climate anomalies on society. The advantage of tree ring-based climate reconstructions is that these reconstructions can be dated to exact calendar years and, therefore, directly compared to written sources.

Already in 1914, Andrew E. Douglass proposed that a series of climate-sensitive tree rings could provide novel material to study the environmental conditions of historical events. Harold C. Fritts et al. addressed the historical community in 1980 and introduced modern tree-ring research and the information it made available to historical scholars.[3] However, it took several decades before the historians took full advantage of the information captured in the tree rings. For a long time, it was left to natural scientists to tell the story of past climatic variations and their relationship to historical events. Bruce M. S. Campbell was one of the first historian to include tree-ring data alongside written sources in his study on the connections between environment and society in pre-modern England.[4] Since then, tree-ring data have increasingly been used as a source of supplementary material in historical research. For example, the "Old World Drought Atlas"[5] provides evidence of the hydroclimatic conditions which prevailed over Europe and contributed to the large-scale crop failures and the outbreak of the Great Famine (1315–1317/1322) (Figure 1).[6]

The reliability, validity and relevance of climate reconstructions based on natural sources like tree rings should be evaluated as carefully and critically as written sources. Using the fourteenth-century crises in northeastern Europe (modern-day Finland and North-West Russia, Figure 2) as a case study, this article demonstrates how tree-ring data can be used as historical source. Medieval northeastern Europe is a particularly interesting case study for such research because climate-sensitive tree-ring data are widely available from this area. The written historical record from this region, on the other hand, especially along the northern shores of the Gulf of Finland and Lake

2 Eugene R. Wahl/ David Frank, Evidence of Environmental Change from Annually Resolved Proxies with Particular Reference to Dendrochronology and the Last Millennium, in: John A. Matthews (ed.), The SAGE Handbook of Environmental Change, vol. 1, London 2012, pp. 320–345.

3 Andrew E. Douglass, A method of estimating rainfall by the growth of trees, in: Bulletin of the American Geographical Society 27 (1914), pp. 321–335, here p. 322; Harold C. Fritts/ G. Robert Lofgren/ Geoffrey A. Gordon, Past climate reconstructed from tree rings, in: The Journal of Interdisciplinary History 10 (1980), pp. 773–793.

4 Bruce M. S. Campbell, Nature as historical protagonist. Environment and society in pre-industrial England, in: The Economic History Review 63 (2010), pp. 281–314.

5 Edward R. Cook et al., Old World megadroughts and pluvials during the Common Era. Science Advances 1 (2015), pp. 1–9.

6 On the Great Famine see the introduction of Bauch/ Schenk and the contributions of Camenisch, Kiss/ Piti/ Sebök et al., Labbé, Nanni, Preiser-Kapeller/ Mitsiou, Schuh, and Vadas in this volume.

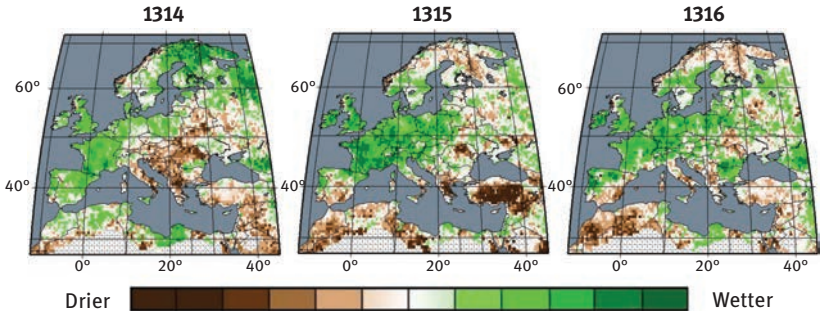

Figure 1: Tree-ring reconstructed summer season variations of drought and wetness, 1314–1316. The green shades indicate wetness and the brown drought.[7]

Ladoga, is quite limited, which has hindered the research on this area. The inclusion of scientific data in historical research thus presents an opportunity to expand scholars' understanding of the history of the region. At the same time, detailed Russian chronicles for the southern parts of the study area – including, for example, the 'Novgorod First Chronicle'[7,8] – allow for a direct comparison of written sources and tree-ring data.

This study focuses on the northeastern corner of Europe, where Sweden (to the west) and Novgorod (to the east) were the dominating powers in the fourteenth century. The northwestern parts of the study area – i.e., roughly the areas covered by modern-day southern and western Finland – were gradually incorporated into the Swedish Realm in the thirteenth and fourteenth centuries. The urban center of the area was Veliky Novgorod, the heart of the Novgorod principality and the easternmost post of the Hanseatic League. Karelia in the northeast was of interest to both Sweden and Novgorod. Although trade was an important part of the economy in the Russian towns of Novgorod, Pskov, and Ladoga, the majority of the population in the area studied here relied on agriculture and fishing for their livelihoods with supplementary herding and hunting.[9]

2 Tree-Ring Series as a Primary Source

Tree rings hold annually resolvable climate proxies that can be transformed, for example, into estimates of growing season temperature, precipitation, and cloud cover variability. By combining tree-ring series from living, historical, archeological, and fossil materials, dendrochronologies can extend back thousands of years.

7 The variations of drought and wetness are indicated with self-calibrating Palmer Drought Severity Index (−6, …, +6). See Cook et al. (note 5) for details.

8 The Chronicle of Novgorod 1016–1471, ed. Robert Michell/ Nevill Forbes, London 1914, p. 119.

9 Vladimir L. Ianin, Medieval Novgorod, in: Maureen Perrie (ed.), The Cambridge History of Russia, vol. 1, From early Rus' to 1689, Cambridge 2006, pp. 188–210, here pp. 198–201. Livonia (i. e. modern day Estonia and Latvia) have been excluded from this analysis.

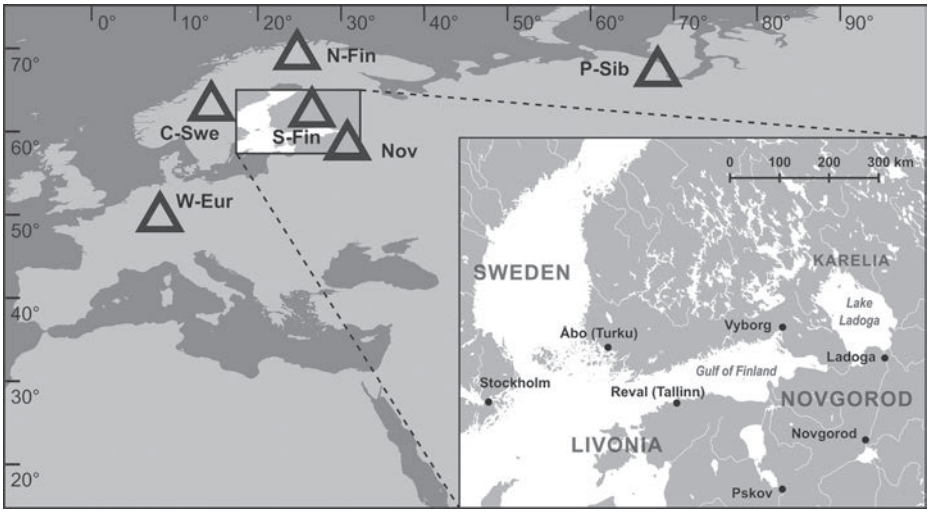

Figure 2: The area of this study and the approximate sampling sites (triangles) of the tree-ring material used in this study: S-Fin (southern Finland, reconstructed May–September temperature[10] and May–June precipitation[11]), C-Swe (central Sweden, April–September temperature[12]), N-Fen (northern Fennoscandia, June–August temperature[13]), P-Sib (Polar Siberia, June–July temperature[14]), Nov (Novgorod, February–May temperature[15]), and W-Eur (western Europe, April–June precipitation[16]).

To reconstruct past climate variability from these series, first a statistical relationship between the tree-ring proxy and climate needs to be established. This relationship can be then calibrated over a period when the tree-ring proxy and instrumental

10 Samuli Helama et al., A palaeotemperature record for the Finnish Lakeland based on microdensitometric variations in tree rings, in: Geochronometria 41 (2014), pp. 265–277.

11 Samuli Helama/ Jouko Meriläinen/ Heikki Tuomenvirta, Multicentennial megadrought in northern Europe coincided with a global El Niño–Southern Oscillation drought pattern during the Medieval Climate Anomaly, in: Geology 37 (2009), pp. 175–178.

12 Björn E. Gunnarson/ Hans W. Linderholm/ Anders Moberg, Improving a tree-ring reconstruction from west-central Scandinavia. 900 years of warm-season temperatures, in: Climate Dynamics 36 (2011), pp. 97–108.

13 Vladimir Matskovsky/ Samuli Helama, Testing long-term summer temperature reconstruction based on maximum density chronologies obtained by reanalysis of tree-ring data sets from northernmost Sweden and Finland, in: Climate of the Past 10 (2014), pp. 1473–1487.

14 Keith R. Briffa et al., Reassessing the evidence for tree-growth and inferred temperature change during the Common Era in Yamalia, northwest Siberia, in: Quaternary Science Reviews 72 (2013), pp. 83–107.

15 Samuli Helama et al., Something old, something new, something borrowed. New insights to human-environment interaction in medieval Novgorod inferred from tree rings, in: Journal of Archaeological Science: Reports 13 (2017), pp. 341–350.

16 Ulf Büntgen et al., 2500 years of European climate variability and human susceptibility, in: Science 331 (2011), pp. 578–582.

meteorological measurement series overlap. With these established statistical relations, the proxy measurements can be translated into climate reconstruction which extends beyond the time of meteorological record keeping. The reconstruction approach is based on the assumption that the relation between the proxy and the climate variable in question was the same in the past as it is in the calibration period. Which climate variables can be reconstructed from the tree rings depends on where the trees grew and the parameters measured. For example, tree-ring width (TRW) of Scots pine in southern Finland can indicate hydrological variability in early summer, whereas in northern Finland TRW is primarily an indicator of temperature fluctuations during the summer season. However, measuring tree-ring maximum density (MXD) instead of TRW in the southern Finnish tree-ring material results in a series that is more indicative of mean temperature variability during the growing season.[17]

Dendroclimatologists are working on a variety of matters which may influence the reconstruction, like data homogeneity, growth coherence and removal of non-climatic trends out of tree-ring chronologies, among other things. Historians who incorporate dendrochronological research into their own studies can hardly be expected to have the same scientific skills. Nevertheless, they should apply the critical source assessment common in their own discipline to the natural sources, as well to define what exactly the tree-ring studies indicate and whether these findings are relevant and valid for exploring their own research questions.

The first step in using dendrochronological data as historical source material is to define the "response window" of the reconstruction. In other words: what climate component(s) (e.g., temperature or precipitation) are reconstructed over which period (e.g., early spring or whole growing season)? Once this has been established, the indications of the "reconstruction skill" should be considered. Reconstructions estimate climate variability with varying degrees of accuracy. Scientists commonly test the reconstruction skill by correlating tree-ring series with measured observations from nearby meteorological stations. Furthermore, it is also essential to pay attention to the results of calibration and verification statistics. In the calibration-verification approach, which is standard in dendroclimatological research, the period of overlapping tree-ring data and station data is divided into two subperiods. One period is used to calculate the reconstruction model (calibration) and the other as an independent check for the model (verification). Commonly, the calibration-verification approach is applied to the data in two steps in which both subperiods are checked against each other.

Additionally, the "spatial domain" of the reconstruction can be explored by correlating the tree-ring series with field data (see Figures 3a and 3b). Tree-ring data are

17 Stefan Brönnimann/ Christian Pfister/ Sam White, Archives of nature and archives of societies, in: Sam White/ Christian Pfister/ Franz Mauelshagen (eds.), The Palgrave Handbook of Climate History, Basingstoke, Hampshire 2018, pp. 27–36, here p. 34; Helama et al. (note 11), pp. 175–178.

commonly collected in locations where tree growth is most sensitive to the climatic variable being examined, that is, from marginal areas of tree-growth. For example, reconstructions of temperature are often based on tree-ring material from along the timberline. Therefore, reconstructions commonly cover peripheral areas which are far away from the medieval population centers. Thus, it is important to define whether – and how well – the tree-ring reconstruction explains the climate variability in the area of interest.

The last thing that historians should consider when drawing on dendrochronological research is the "sample replication," that is, the number of tree-ring measurement series used to calculate the mean tree-ring chronology. In general, the more samples the better. The number of samples commonly declines moving back over time. A lower number of samples might, in turn, limit the reconstruction skill and create uncertainty over the earlier centuries. Although the tree-ring mean chronology might perform well when correlated with station data (because the sample replication is commonly high over recent centuries, for which meteorological measurements are also available), the declining sample number may influence the reconstruction back in time. This matter is especially a concern of medievalists, as tree-ring based climate reconstructions with a sufficient sample replication extending throughout the Middle Ages are available only from few locations. Additionally, the results of the expressed population signal (EPS) statistics indicate how well a chronology based on a limited number of trees represents the hypothetical perfect chronology.[18]

In this study the analysis of several selected regional dendrochronological climate reconstructions is used to evaluate whether northeastern Europe was affected by an unfavorable climate in the 1310s, and more generally in the fourteenth century as a whole. There are a variety of reconstructions available for this period of regional, continental, and hemispheric scope.[19] Although large-scale – i.e., continental and hemispheric – reconstructions provide invaluable material for comparisons of ongoing climatic change with past changes, historians are typically interested in regional reconstructions which cover their areas of interest. Several tree-ring based reconstructions are available for northeastern Europe, including the center of the study area, the city of Novgorod (see Figure 2).

18 Harold C. Fritts, Tree Rings and Climate, London, New York, San Francisco 1976, pp. 15–23; Jan Esper et al., Ranking of tree-ring based temperature reconstructions of the past millennium, in: Quaternary Science Reviews 145 (2016), pp. 134–151; Ulf Büntgen et al., Effects of sample size in dendroclimatology, in: Climate Research 53 (2012), pp. 263–269.

19 For summary on available reconstructions, see, e. g.: Lea Schneider et al., Revising midlatitude summer temperatures back to AD 600 based on a wood density network, in: Geophysical Research Letters 42 (2015), pp. 4556–4562; Rob Wilson et al., Last millennium northern hemisphere summer temperatures from tree rings. Part I: The long term context, in: Quaternary Science Reviews 134 (2016), pp. 1–18.

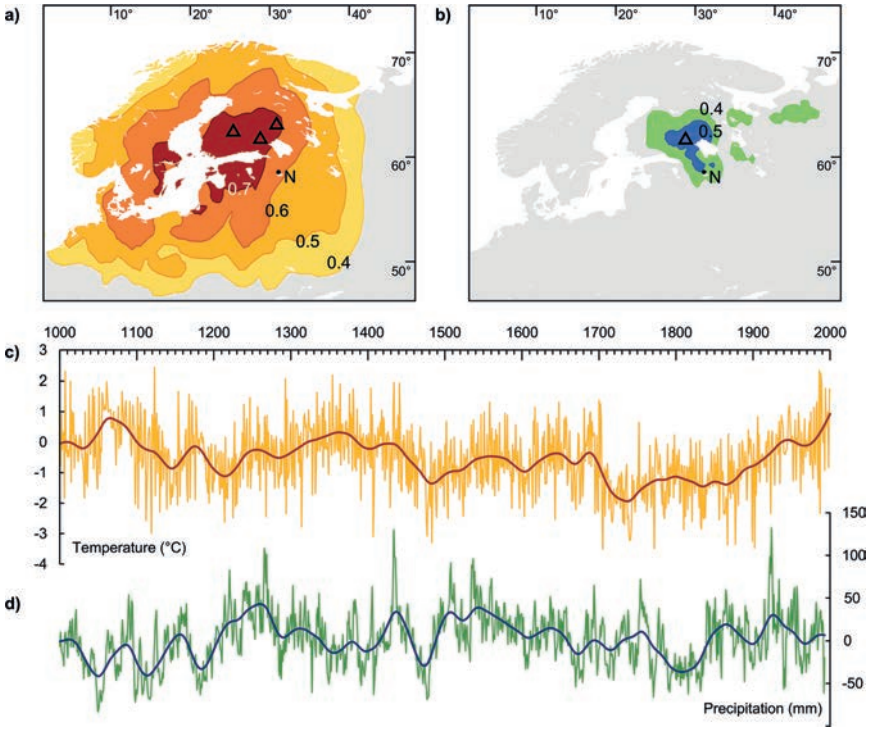

Figure 3: Field-correlations (Pearson correlation coefficient) between the CRU TS 3.24 data set[20] **a)** averaged May–September temperatures and reconstructed temperature[21] and **b)** May–June precipitation sum and TRW reconstructed precipitation[22] variability. The triangles indicate the average sampling site of the tree-ring material. The city of Novgorod (N) is marked on the maps. Reconstructed annual (orange, green) and long-term (red, blue) **c)** temperature and **d)** precipitation anomalies over the past millennium with respect to the 1961–1990 mean (same data as in a and b); **e)** the reconstructed winter Arctic Oscillation (AO, bars, scale on left)[23] and winter North Atlantic Oscillation (NAO, dashed line, scale on right)[24] indexes over the past millennium (see Chapter 4); **f)** temperature, precipitation, and the AO and NAO index anomalies over the fourteenth century with respect to the century mean.

20 University of East Anglia Climatic Research Unit, Ian C. Harris/ Philip D. Jones, CRU TS3.23. Climatic Research Unit (CRU) Time-Series (TS) Version 3.23 of High Resolution Gridded Data of Month-by-month Variation in Climate (Jan. 1901- Dec. 2014). Centre for Environmental Data Analysis, 09 November 2015 [http://www.cru.uea.ac.uk/].

21 Helama et al. (note 10).

22 Helama et al. (note 11).

23 Guoqiang Chu et al., Snow anomaly events from historical documents in eastern China during the past two millennia and implication for low-frequency variability of AO/NAO and PDO, in: Geophysical Research Letters 35 (2008), pp. 1–4. Valérie Trouet et al., Persistent positive North Atlantic Oscillation mode dominated the medieval climate anomaly, in: Science 324 (2009), pp. 78–80.

24 Valérie Trouet et al., Persistent positive North Atlantic Oscillation mode dominated the medieval climate anomaly, in: Science 324 (2009), pp. 78–80.

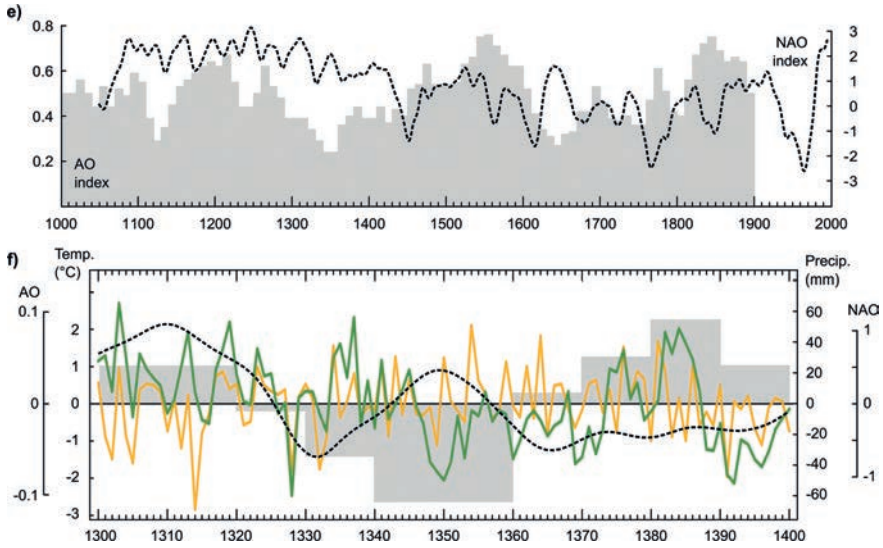

Figure 3 (continued)

Tree-ring width series from the region of Novgorod correlate with late winter and spring temperatures. Consequently, TRW series that have been compiled using archeological material from the medieval city of Novgorod indicate February–May temperature variability.[25] However, the Novgorod chronology is not continuous: it has a gap of almost five hundred years from the fifteenth to nineteenth century. Moreover, the TRW series explains only 32 percent of the measured temperature variance, which is considerably lower than other reconstructions from the adjacent areas. The reconstructions with the highest reconstruction skill over the studied area and sufficient fourteenth-century data originate from southern Finland (Figures 3a and 3b). From these, the growing season (May–September) temperature reconstruction[26] attained from MXD data explains up to 60 percent of the measured twentieth-century variance, and the early summer (May–June) precipitation reconstruction[27] from TRW series accounts for 40 percent of the measured precipitation variance. The temperature reconstruction shows high spatial coherence over the whole study area, whereas the spatial coverage and the reconstruction skill of the precipitation reconstruction is less coherent (Figure 3b). This is because precipitation variability has weaker spatial synchrony over long distances than temperature. Moreover, the tree-ring response

25 Helama et al. (note 15).
26 Helama et al. (note 10).
27 Helama et al. (note 11).

to precipitation is more dominated by "noise" and local site influences than the response to temperature.[28]

In certain circumstances, tree-ring data can be used not only as a climate proxy but also to estimate past harvest fluctuations. This is because in marginal areas of crop cultivation, like northeasternmost Europe, the same climatic components largely determine tree growth and crop yields: the length and thermal conditions of the growing season. Consequently, the pre-industrial crop yield variability correlates strongly and significantly with the mean temperatures during the growing season, as does the tree-ring density (MXD) data.[29] Thus, annual yield ratio (harvested seed in relation to sowed seed) anomalies have been reconstructed from MXD series. This reconstruction explains approximately 50 percent of the pre-industrial crop yield variability in central and northern Finland (north of 62° N).[30] In addition, tree-ring based temperature reconstructions from northern Scandinavia,[31] central Sweden,[32] and Polar Siberia[33] were used for comparison along with precipitation reconstruction from western Europe.[34] The average sampling sites of the reconstructions are indicated in Figure 2.

3 The Great Famine

There is a longstanding debate among historians over the extent to which climate contributes to famine.[35] The Great Famine (1315–1317/1322) is one of the few cases in which they commonly agree that there is a strong association with adverse climate.

28 Keith R. Briffa et al., Tree-ring width and density data around the Northern Hemisphere. Part 1: local and regional climate signals, in: The Holocene 12 (2002), pp. 737–757, here p. 746; Jari Holopainen/ Samuli Helama, Little Ice Age farming in Finland. Preindustrial agriculture on the edge of the Grim Reaper's scythe, in: Human Ecology 37 (2009), pp. 213–225, here p. 221.

29 Heli Huhtamaa et al., Crop yield responses to temperature fluctuations in 19th century Finland: provincial variation in relation to climate and tree-rings, in: Boreal Environmental Research 20 (2015), pp. 707–723, here pp. 713–715.

30 Heli Huhtamaa/ Samuli Helama, Reconstructing crop yield variability in Finland. Long-term perspective on the cultivation history in the agricultural periphery since 760 AD, in: The Holocene 27 (2017), pp. 3–11. See, Figure 2 (S-Fin and N-Fen series) for the approximate sampling sites of the tree-ring data.

31 Matskovsky/ Helama, (note 13).

32 Gunnarson/ Linderholm/ Moberg (note 12).

33 Briffa et al. (note 14).

34 Büntgen, (note 16).

35 Philip Slavin, Climate and famines. A historical reassessment, in: WIREs Climate Change 7 (2016), pp. 433–447, here pp. 435–438.

A series of harsh and stormy winters combined with rainy summers and flooding in 1314–1316 caused harvests to fail in large parts of Europe and indirectly affected animal husbandry, which triggered the famine among vulnerable groups of societies.[36] The famine coincided with a period of exceptionally warm sea surface temperatures in the North Atlantic that provided abundant moisture for the rains.[37] Although the famine and its association with extreme precipitation in northwestern Europe have been investigated in detail, the northeastern extent of the famine remains undefined. Henry S. Lucas concluded that although the written historical record from Scandinavia and northern Russia is scarce on the topic, the climatic conditions troubling northwestern Europe must have prevailed further east, as well.[38] Later, Wolfgang Behringer proposed that the famine "reached from the British Isles to Russia and from Scandinavia to the Mediterranean,"[39] whereas William C. Jordan suggested that "the far eastern Baltic was not affected directly by harvest shortfalls."[40]

3.1 Climate, Harvest and Hunger in the 1310s

According to the reconstructed drought-wetness index, the northeast did not experience consecutive wet summers like western Europe did (Figure 1). Whereas the early summer precipitation increased from 20 to 40 percent in northwestern Europe during 1314–1316, in the northeast, precipitation levels remained close to or below the fourteenth-century mean (Figure 4a). The tree-ring material thus indicates that the adverse conditions did not extend to the northeastern shore of the Baltic Sea, suggesting the opposite what Lucas has proposed.

36 William C. Jordan, The Great Famine. Northern Europe in the Early Fourteenth Century, Princeton 1996, pp. 15–21; Henry S. Lucas, The Great European Famine of 1315, 1316, and 1317, in: Speculum 5 (1930), pp. 343–377, here pp. 345–351; Philip Slavin, The 1310s event, in: Sam White/ Christian Pfister/ Franz Mauelshagen (eds.), The Palgrave Handbook of Climate History, Basingstoke, Hampshire 2018, pp. 495–515, here p. 497; Timothy P. Newfield, A cattle panzootic in early fourteenth-century Europe, in The Agricultural History Review 57 (2009), pp. 155–190, here p. 172; Sam Geens, The Great Famine in the county of Flanders (1315–17): the complex interaction between weather, warfare, and property rights, in: The Economic History Review 71 (2018), pp. 1048–1072, here p. 1069.

37 A. G. Dawson et al., Greenland (GISP2) ice core and historical indicators of complex North Atlantic climate changes during the fourteenth century, in: The Holocene 17 (2007), pp. 427–434, here p. 433.

38 Lucas (note 36), here p. 347.

39 Wolfgang Behringer, A Cultural History of Climate, Cambridge, Malden 2010, p. 104.

40 Jordan (note 36), here p. 12.

On the other hand, rainfall alone may be a fairly insignificant factor: hydrological anomalies were not the primary cause of severe, large-scale crop failures in the studied area. As precipitation trends vary greatly from one place to another, drought and excessive rain usually caused crop failures only on a local scale in the northeastern Europe. Moreover, along the northern margin of arable cultivation, fluctuations in crop yields are influenced more by temperature than by precipitation. In these areas, especially, it was the onset and thermal conditions of the growing season that determined the success of the harvest. A late start to the growing season or a cool summer delayed the ripening of the grain and in turn increased the chances that an early autumn night frost (in August/ September) should cause the crop to fail. Trends in temperature during the growing season were fairly consistent over larger areas, meaning that in years of especially short, cool growing seasons, frosts could cause severe, widespread crop failures close to the harvest time.[41] If the onset of the growing season was delayed and summer remained unusually cold in one part of the studied region, the situation was likely similar all over the region. Cool spring and summer temperature anomalies delayed the ripening of crops everywhere in the area to a period when the risk of frost at night was increased. In cases of rainfall destroying the harvest in one location, however, the hydrological conditions in other regions might have been more favorable, so that the harvests were only locally affected.

Over the early 1310s, the growing season of 1314 was extremely cool (Figure 3f), indicating that the ripening of the grain must have been delayed in that year. However, during the second half of the 1310s, the temperature reconstructions indicate rather favorable conditions. In southern Finland, the mean temperature during the growing seasons between 1315–1320 was slightly warmer than the fourteenth-century mean. In the adjacent regions of northern Scandinavia and polar Siberia, the 1315–1320 mean summer temperatures were almost one Celsius degree warmer than the century mean. Further east, in temperate East Asia, summer temperatures overall were distinctly warm between 1314–1327, possibly even comparable to late twentieth-century (1961–1990) conditions. Moreover, the spring (February–May) temperature reconstruction compiled from the archeological wood material from the city of Novgorod indicates that springs during the mid-1310s were slightly warmer than the late-fourteenth-century average (Figure 4b).[42]

41 Huhtamaa et al. (note 29), pp. 713–716.

42 Temperature reconstructions (respectively): Helama et al. (note 10); Matskovsky/ Helama (note 13); Briffa et al. (note 14); Cook et al., Tree-ring reconstructed summer temperature anomalies for temperate East Asia since 800 CE, in: Climate Dynamics 41 (2013), pp. 2957–2972; Helama et al. (note 15).

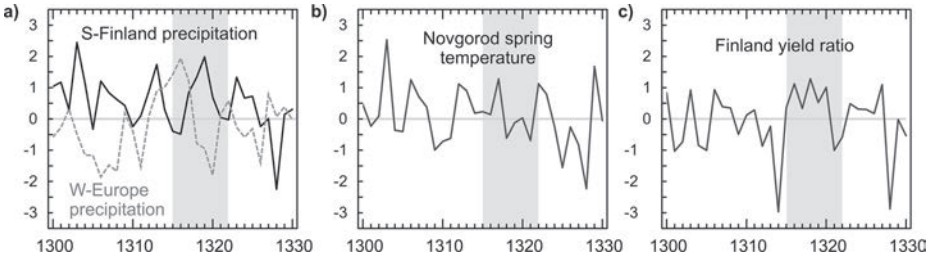

Figure 4: a) Southern Finland precipitation[43] (solid black line) and western Europe precipitation[44] (dashed grey line); **b)** Novgorod February–May temperature[45]; and **c)** Finland crop yield ratio[46] anomalies. All series are standardized over the fourteenth century. The years 1315–1322 are highlighted.

While there is some evidence that Sweden[47] and Livonia[48] to the west may have faced severe food shortage, or even famine, in the second half of the 1310s, written sources documenting the crisis' extent further east and north are scant. Early autumnal frost most likely caused considerable crop damage in Pskov in 1314.[49] As discussed above, the growing season in 1314 was extremely cool, which most likely contributed to the severity and extent of the frost damage.

The 'Novgorod First Chronicle,' which is based on the annals of the city of Novgorod, mentions that bread was expensive in the winter of 1314–1315 in Novgorod and that, in Pskov, men were "looting villages [...] and storehouses."[50] However, the accounts of the food shortage in 1314 differ markedly from other famine narratives

43 Helama et al. (note 11).

44 Büntgen et al. (note 16).

45 Helama et al. (note 15).

46 Huhtamaa/ Helama (note 30).

47 Gustaf Utterström, Climatic fluctuations and population problems in early modern history, in: Donald Worster (ed.), The Ends of the Earth. Perspectives on Modern Environmental History, Cambridge 1988, pp. 39–79, here pp. 52–53 n. 37. Ericus Olai (died 1486) writes that in 1314 Sweden suffered from famine, see Olai, Chronica Erici Olai, ed. Erik M. Fant/ Erik G. Geijer/ Johan H. Schröder (Scriptores Rerum Suecicarum Medii Aevi 2), Uppsala 1828, p. 92 and six years later, a letter that is dated 26th of August 1320 documents that Stockholm was still in great need of grain, see Rainhold Hausen, Finlands medeltidsurkunder vol. 1, Helsinki 1910, no. 295.

48 Balthasar Rüssow (died 1600) writes how horrifying famine ranged in Livonia from 1315 for three years, as each year both rye and barley froze on the fields, see Balthasar Rüssow, Chronica der Prouintz Lyfflandt, Rostock 1578, pp. 32–33. Also Bartholomäus Hoeneke (died circa mid-14th century) and Hermann von Wartberge (died 1380) documented Livonia suffering from famine in 1315, see Bartholomäus Hoeneke, Die jüngere Livländische Reimchronik 1315–1348, ed. Konstantin Höhlbaum, Leipzig 1872, p. 1; Hermann von Wartberge, Chronicon Livoniae, ed. Ernst Strehlke, Leipzig 1863, p. 50.

49 Matthias Akiander, Utdrag ur Ryska annaler, Suomi – Tidskrift i fosterländska ämnen 1848, Helsinki 1849, pp. 1–284, here p. 83.

50 The Chronicle of Novgorod 1016–1471 (note 8), p. 119.

in the chronicle. For example, the chronicle describes how a century earlier, when a severe famine afflicted the region, the population consumed unwholesome famine[51] and taboo[52] foods, even resorting to cannibalism, and mothers traded their babies for bread.[53] All of these are typical motifs of famine events in the chronicle, but the entry for 1314 includes none of them. Moreover, the chronicle makes no mention of food scarcity or high prices from 1315–1322, when western Europe was in the grips of the famine.[54] There is no written evidence from Finland or Karelia documenting a famine or the absence of one. However, reconstruction of central and northern Finland yield ratios based on tree-ring density data corroborate the chronicle's claim that the harvest in 1314 was poor (Figure 4c). In fact, the reconstruction estimates that the yield ratio for 1314 was the lowest of the entire century.

Northeastern Europe thus seems not to have experienced the excessive rainfall that regions further west did (Figures 1 and 4a). Nevertheless, growing conditions in 1314 were unfavorable throughout the studied area. In Pskov, frost damaged the fields before the peasants had harvested them. Further north, crop yields reached the lowest point of the century. The price of bread rose over the Novgorodian lands for the following year. These adverse conditions, however, did not last into the second half of the 1310s, which raises the question as to whether one bad year was enough to trigger a famine. In other words, could the anomalously cold year 1314 paralyze the food system(s) and cause a severe shortage of food?

3.2 Food System Resilience to Adverse Climate and Weather

Food systems are dynamic systems that encompass the production, processing, distribution, preparation, and consumption of food.[55] Food systems in the area under study here differed from region to region in the fourteenth century. In northern and central Finland, the semi-nomadic Sámi people relied primarily on fishing as the source of their livelihood and supplemented this by herding reindeer and hunting game. The forest dwellers of Finland and Karelia practiced small-scale crop cultivation, fishing, and hunting, while the sedentary farmers on the shores of the Baltic Sea supplemented their livelihood with fishing and seal hunting. Residents of the

51 Such as moss, snails, pine-bark, lime-bark, lime and elm-tree leaves.

52 Horseflesh, dogs and cats.

53 The Chronicle of Novgorod 1016–1471 (note 8), p. 75.

54 However, the chronicle (Ibid., p. 120) mentions enemy troops dying of hunger in 1316 while retreating and getting lost on the lakes and the swamps. Yet, it is rather clear that the hunger was temporary and resulted from military activities. Thus, connecting the hunger incident to the European Great Famine would be rather questionable.

55 Peter J. Gregory/ John S. I. Ingram/ Mike Brklacich, Climate change and food security, in: Philosophical Transactions of the Royal Society of London B: Biological Sciences 360 (2005), pp. 2139–2148, here pp. 2141.

hinterlands of Novgorod and Ladoga cultivated a number of diverse crops on a larger scale. The food systems in the urban centers relied primarily on grain production in their hinterlands and only secondarily on trade over longer distances.[56]

As a result of this diversity of food systems, the adverse conditions of 1314 affected only those areas where food systems depended on crop cultivation – roughly the southern parts of the area studied. Moreover, even within those areas with agrarian food systems, the diversity of crops cultivated could increase the resilience to unfavorable climatic conditions. In Novgorod and Ladoga, for example, the variety of cultivated crops was up to three times larger than in Livonia on the west at the same time. Because different crops are sensitive to different climatic factors, total failure rarely struck all the cultivated species simultaneously. Moreover, different agricultural practices, such as slash-and-burn cultivation and the cultivation of winter crops, reduced the vulnerability of the food system in the area. Vegetables grown in home gardens in the countryside and towns also supplemented the daily diet.[57]

A single year of crop failure thus hardly ever paralyzed the food system. Instead, severe food shortages in the Middle Ages were usually a product of back-to-back failed harvests.[58] Written sources do not show any sign of a shortage of food in 1315–1322, and the tree-ring evidence suggests favorable conditions – warm growing season with moderate rainfall – for this period (Figure 4).

Further north, the food systems were simpler: barley and rye were the only crops routinely cultivated, which increased sensitivity to climate and weather. However, in these areas, grain products constituted only one part of the daily diet; wild resources were important components of the food system, as well. Much of the areas studied relied on fishing as a key element of food production in addition to the cultivation of crops and vegetables. The number of lakes and waterways throughout Finland and

56 Heli Huhtamaa, Climatic anomalies, food systems, and subsistence crises in medieval Novgorod and Ladoga, in: Scandinavian Journal of History 40 (2015), pp. 562–590, here pp. 565–566; Jukka Korpela, Migratory Lapps and the population explosion of Eastern Finns. The early modern colonization of Eastern Finland reconsidered, in: Charlotte Damm/ Janne Saarikivi (eds.), Networks, interaction and emerging identities in Fennoscandia and beyond, Helsinki 2012, pp. 241–261, here p. 247; Michael Monk/ Penny Johnston, Plants, people and environment. A report on the macro-plant remains within the deposits from Troitsky site XI in medieval Novgorod, in: Mark Brisbane/ David Gaimster (eds.), Novgorod. The archaeology of a Russian medieval city and its hinterland, London 2001, pp. 113–117, here p. 116; Eljas Orrman, Keskiajan maatalous, in: Viljo Rasila/ Eino Jutikkala/ Anneli Mäkelä-Alitalo (eds.), Suomen maatalouden historia 1. Perinteisen maatalouden aika esihistoriasta 1870-luvulle, Helsinki 2003, pp. 87–114, here pp. 106–114.

57 Huhtamaa (note 56), p. 577; R. E. F. Smith/ David Christian, Bread and salt. A social and economic history of food and drink in Russia, Cambridge, 1984, pp. 8–9.

58 Huhtamaa (note 56), pp. 575, 580; Bruce M. S. Campbell/ Cormac Ó Gráda, Harvest shortfalls, grain prices, and famines in preindustrial England, in: The Journal of Economic History 71 (2011), pp. 859–886, here pp. 865–868; Bruce M. S. Campbell, The European mortality crises of 1346–52 and advent of the Little Ice Age, in: Dominik Collet/ Maximilian Schuh (eds.), Famines During the 'Little Ice Age' (1300–1800), Cham 2018, pp. 19–41 here pp. 20, 29–33.

Karelia (see Figure 2) made fish an important source of nutrition, as archeological evidence from southeast Finland and Novgorod and its hinterlands confirms.[59]

Yet, cold summers, like the one in 1314, can be unfavorable for some fish species, including cyprinids and pike perch, which were the most frequently consumed fish in Novgorod. Because fry and juvenile fish are more vulnerable to climate than mature fish, the effects on fish populations usually lags from a few years to a decade behind.[60] Therefore, although the year 1314 was most likely unfavorable for the fish, it took likely several years before the consequences began to show in the fish catch. Similarly, the effects of climate on game are often delayed, as the impact of climate on game populations are commonly indirect (for example, through the variations in the availability of food).[61]

A further factor affecting food availability was the variety of techniques used in processing food. For example, in Finland drying was the principal form of preserving fish until the availability of salt increased after the mid-fourteenth century, after which salting slowly became the main method of preservation.[62] Consequently, the food system was connected to the salt-producing areas, which meant local climate and weather were no longer the sole factors affecting the food system, but the conditions at the origin of salt also played a role. This is evident, for example, in the case of the Finnish famine of the 1690s: adverse weather conditions in southwestern Europe, where the salt originated at the time, caused a shortage of salt. As a result, people in Finland could not preserve fish for the winter.[63] In the early fourteenth century, however, the food systems in Finland and Karelia were not connected to the regions in western Europe affected by the rainy weather and resulting salt deficiency.[64] The

59 Mark Maltby, From *Alces* to Zander. A summary of zooarchaeological evidence from Novgorod, Gorodishche and Minono, in: Mark A. Brisbane/ Nikolaj A. Makarov/ Evgenij N. Nosov (eds.), The archaeology of medieval Novgorod in context. Studies in centre/ periphery relations, Oxford 2012, pp. 351–380, here pp. 366–369; Elena A. Rybina, The birch-bark letters. The domestic economy of medieval Novgorod, in: Mark Brisbane/ David Gaimster (eds.), Novgorod. The archaeology of a Russian medieval city and its hinterland, London 2001, pp. 127–131, here pp. 128–129; Mia Lempiäinen-Avci/ Ville Laakso/ Teija Alenius, Archaeobotanical remains from inhumation graves in Finland, with special emphasis on a 16th century grave at Kappelinmäki, Lappeenranta, in: Journal of Archaeological Science: Reports 13 (2017) 132–141, here p. 138.

60 Jakob Kjellman/ Jyrki Lappalainen/ Lauri Urho, Influence of temperature on size and abundance dynamics of age-0 perch and pikeperch, in: Fisheries Research 53 (2001), pp. 47–56; Erik Jeppesen et al., Impacts of climate warming on lake fish community structure and potential effects on ecosystem function, in: Hydrobiologia 646 (2010), pp. 73–90; Huhtamaa (note 56), p. 567.

61 Chuan Yan et al., Linking climate change to population cycles of hares and lynx, in: Global Change Biology 19 (2013), pp. 3263–3271, here p. 3268.

62 Tapio Salminen, Vantaan ja Helsingin pitäjän keskiaika, Vantaa 2013, p. 493.

63 J. Neumann/ S. Lindgrén, Great historical events that were significantly affected by the weather: 4, The great famines in Finland and Estonia, 1695–1697, in: Bulletin American Meteorological Society 60 (1979), pp. 775–787, here pp. 780.

64 Slavin (note 36), p. 501.

northern food systems were overwhelmingly local, with foodstuffs produced, gathered, and consumed within a limited area.

Novgorod, on the other hand, was integrated in some respects into a continental food system. The city of Novgorod was located at the crossroads of the main trade routes between Europe and the East. Still, Novgorod was not dependent on imported grain; archeological evidence suggests that the grain consumed in the city was produced locally. The fact that the main component of the food regime, grain cultivation, did not rely on the affected areas in the west that were suffering from adverse weather over three years in 1314–1316 protected Novgorod from the worst of the famine.[65]

In summary, the harvest in 1314 was most likely extremely poor throughout the area studied here, but the food systems in some parts of the northeast were more diverse and in other parts less dependent on crop cultivation than many contemporary western systems. Although the food systems in the north – among the Finnish, Karelian and Sámi populations – were distinctly different from the food systems over the Novgorodian lands in the south, all of these had components that made them resilient to short-term weather anomalies. Moreover, as it was commonly back-to-back harvest failures that produced severe food shortages, it is thus rather unlikely that the crop failure in 1314 would have escalated to a famine comparable to the Great Famine that was raging in the west.

4 Crises of the Fourteenth Century in the Northeast?

The Great Famine, however, is only one component of the climate-related crises of the fourteenth century. The 1314–1316 weather anomalies were likely connected to a wider climatic shift taking place over the fourteenth century.[66] After the subsequent rainy summers of the 1310s, large parts of Europe experienced increased climatic instability over the following decades. This increased instability is commonly associated with changing patterns of climatic modes, mostly in the patterns of the North Atlantic Oscillation (NAO) and the Arctic Oscillation (AO), witch, in turn, influence temperatures, precipitation, winds and storminess in large parts of Europe. Coinciding this period of climatic instability, the commoners' entitlement to food decreased and the rulers across Europe were involved in a number of territorial wars. It became more difficult to maintain the existing socio-ecological balance as a result, and European economic systems became more vulnerable. By mid-century, the tipping point had been

65 Michael Monk/ Penny Johnston, Perspective on non-wood plants in the sampled assemblage from the Troitsky excavations of medieval Novgorod, in: Mark A. Brisbane/ Nikolaj A. Makarov/ Evgenij N. Nosov (eds.), The archaeology of medieval Novgorod in context. Studies in centre/periphery relations, Oxford 2012, pp. 283–320, here p. 317; Ianin (note 9), p. 201.
66 Slavin (note 36), p. 508.

reached, so that the sudden worsening of growing conditions and the plague which reached Europe around this same time both contributed to a pan-regional crisis.[67]

Bruce M. S. Campbell has demonstrated how the environmental downturn of the mid-fourteenth century is evidenced in tree-ring material across Eurasia.[68] In accordance with his findings, tree-ring density series from northernmost Scandinavia and central Sweden indicate the downturn.[69] In Novgorod and southern Finland, however, climatic conditions in the mid-fourteenth century seem to differ. These local reconstructions suggest that drier and warmer summers prevailed in northeastern Europe in mid-century (Figure 3). Moreover, a spring (February–May) temperature reconstruction based on archeological tree-ring width series from the city of Novgorod indicates that, from the beginning of the fourteenth century, cold springs were less frequent than in the earlier centuries.[70]

In addition, reconstructed winter NAO and AO indexes – negative NAO phase and lower pressure over Arctic – suggest that winters in the area studied were mild in the fourteenth century, especially mid-century (Figure 3). Winter weather and the onset of the growing season in northeastern Europe are dictated to a great degree by atmospheric dynamics, particularly the NAO and the AO. Years of positive winter NAO-phases, when the pressure difference between the Azores and Iceland is strong, experience milder winters in the northeast due to stronger westerly winds, while winters with negative NAO are associated with colder winters in this area. The NAO patterns, which are more regional, usually resemble the patterns of the more general AO. The AO is characterized by differences in atmospheric pressure between the Arctic and the surrounding lower latitudes. When lower pressure prevails over the Arctic, the westerlies are stronger and the cold air is trapped in the polar region, whereas higher than usual pressure over the Arctic results in weaker westerlies, allowing the cold Arctic air to penetrate into mid-latitudes. The severity of winter, and especially the duration of the snow cover (which partly dictates the onset of the growing season), is strongly associated with variations of the AO in the studied area.[71]

---

67 Bruce M. S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval World, Cambridge 2016, pp. 135, 267–286¸ Geens (note 36), here p. 1069.

68 Ibid., pp. 277–279; Campbell, (note 58), 32.

69 Matskovsky/ Helama (note 13); Gunnarson et al. (note 12).

70 Helama et al. (note 15).

71 Samuli Helama/ Jari Holopainen, Spring temperature variability relative to the North Atlantic Oscillation and sunspots. A correlation analysis with a Monte Carlo implementation, in: Palaeogeography, Palaeoclimatology, Palaeoecology326–328 (2012), pp. 128–134; James W. Hurrell et al., An overview of the North Atlantic Oscillation. The North Atlantic Oscillation: Climatic Significance and Environmental Impact, in: James W. Hurrell et al. (ed.), The North Atlantic Oscillation. Climatic significance and environmental impact, Washington DC, 2003, pp. 1–35; Ignatius G. Rigor/ John M. Wallace/ Roger L. Colony, Response of sea ice to the arctic oscillation, in: Journal of Climate 15 (2002), pp. 2648–2663; Sergio M. Vicente-Serrano et al., Role of atmospheric circulation with respect to the

Overall in the fourteenth century, and especially in the 1310s and the mid-century, the winter NAO was in a positive phase and lower than normal pressure prevailed over the Arctic. In fact, the winter AO reconstruction indicates that the lowest pressure over the last millennium prevailed over the Artic in the mid-fourteenth century (Figure 3). This meant stronger westerly winds that brought milder winters to the area studied. Milder winters, warmer springs, longer growing seasons, and warmer summers are all favorable conditions for agriculture in the region covered in this study. As discussed above, in the northern margin of crop cultivation, the most severe production failures were commonly a result of an unusually short and/or cold growing season. Milder winters were associated with an earlier onset of the growing season, which meant that crops ripened earlier and were less likely to be damaged by early autumn frost.

The tree-ring studies thus suggest that growing conditions became, in fact, more favorable for agriculture in northeastern Europe over the first half of the fourteenth century. This was most likely due in part to the prolonged period of the positive mode of the NAO and the weakened AO, which strengthened the westerly winds that brought warm air masses to the area in winter. In other words, the very same modes of climate variability that favorably influenced conditions in the northeast brought likely the torrential rains and storms to the west.[72]

The term teleconnections refers in climate sciences to the appearance of statistical relations between climate anomalies in distant locations.[73] These anomalies may occur simultaneously or with a delay, and they can influence the local weather very differently, as they did in the early fourteenth century. In this volume, the definition of teleconnections is expanded to include manifestations of these climatic anomalies on a societal level. The social consequences can also materialize with some delay and vary significantly between different locations. Various socio-environmental dynamics – including livelihood strategies, food systems, trade networks, and land use – dictate whether, when, how, and to what extent climatic anomalies influence social dynamics.

It was commonly believed that the crisis of the fourteenth century extended into the northeasternmost regions of Europe. Yet, recent analysis had suggested an increase in animal husbandry and crop cultivation in the northern forest areas over the course of the century.[74] In addition, as discussed above, the more diverse food systems of the

interannual variability in the date of snow cover disappearance over northern latitudes between 1988 and 2003, in: Journal of Geophysical Research. Atmospheres 112 (2007), pp. 1–15.

72 Campbell (note 67), pp. 258, 285; Dawson et al. (note 37), p. 430.

73 Anders Ångström, Teleconnections of climatic changes in present times, in: Geografiska Annaler 17 (1935), pp. 242–258; Heinz Wanner et al., North Atlantic Oscillation. Concepts and studies, in: Surveys in Geophysics 22/4 (2001), pp. 321–382.

74 Jukka Korpela, The World of Ladoga. Society, trade, transformation and state building in the eastern Fennoscandian boreal forest zone c. 1000–1555, Münster 2008, p. 218; Vladimir Klimenko, Thousand-year history of northeastern Europe exploration in the context of climatic change. Medieval to early modern times, in: The Holocene 26 (2016), pp. 365–379, here p. 372.

region were less dependent on crop cultivation than many of their neighbors' systems to the west. Moreover, because permanent agriculture was introduced into the region much later than in western Europe, the natural environment had not experienced the same level of degradation as in the west, and the agroecosystem was more resilient as a result.[75] The economy of the urban center in Novgorod strengthened notably in the early fourteenth century. Novgorod had been able to avoid the military devastation of the Golden Horde – unlike the other Rus' principalities – and resist the Swedish and Teutonic Order's aggressions on the west. Consequently, Novgorod became the region's dominant economic power.[76] This economic growth and agricultural expansion suggest that, unlike in the rest of Europe, the subsistence systems in the northeast did not became more vulnerable over the first half of the century. The 'Novgorod First Chronicle' supports this assumption, as the chronicle does not mention a single incident of frost, crop failure, expensive prices, food shortage, or famine between the year 1315 and the early fifteenth century.

In addition to the written sources and social factors, the tree-ring records presented here provide strong evidence that one of the key drivers of the European crisis of the fourteenth century – adverse climatic conditions for crop cultivation – did not extend to the most northeastern corner of Europe. The region was not able to avoid the crises completely, however, only to postpone them. Records of social unrest, war, and plague become more frequent in the Novgorodian chronicle over the second half of the fourteenth century. During the first half of the fifteenth century, coinciding with major changes in the behavior of the NAO and AO, the summers became wetter and cooler (Figure 3). Novgorod suffered what were probably its most severe late-medieval famines in the first half of the fifteenth century and gradually lost its dominating position over the region.[77]

5 Conclusions

This exploration of whether the climate-driven crises of the early fourteenth century affected the northeastern corner of Europe has sought to demonstrate the potential of incorporating tree-ring data into historical research. The various sources analyzed here suggest that the adverse climatic conditions, winter storms, and heavy rains that troubled western Europe in the first half of the fourteenth century did not reach the area studied. In fact, tree-ring reconstructions suggest favorable conditions for agriculture – warm growing seasons and moderate precipitation – in the late 1310s. On the other hand, both tree-ring data and written sources indicate that the harvest in

75 Huhtamaa (note 56), pp. 577.
76 Ianin (note 9), p. 201.
77 Dawson et al. (Note 37), p. 433; Klimenko (note 72), pp. 372–373.

1314 was extremely poor all over the studied area. Yet, the food systems in the northeast were rather diverse, which made them resilient to short-term climate anomalies. Therefore, it is rather unlikely that the single bad harvest in 1314 would have triggered a famine comparable to the crisis in the west. Moreover, the written sources do not indicate any shortage of food over the years 1315–1322.

Interestingly, it appears that it was perhaps the same changes in the behavior of modes of climate variability, mostly in the winter NAO and AO, that brought adverse conditions to the west and favorable conditions to the northeast over the first half of the fourteenth century. This demonstrates how climatic teleconnections can materialize on a societal level in very different ways in different locations. Prior studies have suggested that this region experienced agricultural expansion and economic strengthening early in the century. Tree-ring material provides supplementary information on the climatic conditions of the period. The first half of the fourteenth century was marked by short, mild winters and warm summers with moderate rainfall – ideal conditions for crop cultivation in the region. Combined with the fairly resilient food systems of the region, this makes it likely that northeast Europe was able to escape, at least temporarily, the crises that western Europe was struggling with in the first half of the fourteenth century.

Andrea Kiss, Ferenc Piti, Ferenc Sebők, Éva Teiszler

Food Crisis in Fourteenth-Century Hungary: Indicators, Causes and Case Studies

Abstract: This paper provides an initial overview of the failed harvests, food shortages, and famines reported in fourteenth-century sources from the Kingdom of Hungary and also with some reference to the countries of the Hungarian crown. It examines what might have caused these crises and looks for signs of socioeconomic consequences. Following a discussion of the primary sources – including an overview of the terms which contemporary authors used and of the methodology of interpreting direct and indirect indicators – the paper proceeds with a survey of the potential causes of food shortages. These include both those fourteenth-century meteorological and climate-related events (e.g., weather extremes, floods, fires) and biological hazards (e.g., locusts invasions, plague/pestilence) which have been established for this period, as well as some significant social factors (e.g., feudal anarchy and wars). Finally, it discusses those years for which there are indications of bad harvests, food shortages, dearth, and famine as separate cases studies on the 1310s to the early 1320s, the late 1340s to the early 1350s, early to mid-1360s, (1373–)1374, 1381, and the early to mid-1390s. Those periods which experienced food shortages (e.g. the 1310s and 1374) show thought-provoking parallels with some of the food crises that occurred in central and western Europe during this same time.

Keywords: 14th-century Hungary, food shortages, weather, pestilence, pest invasions, social factors

1 Introduction

The most severe known medieval famine in Hungary was reported during and after the Great Mongol Invasion, in 1241–1243. However, famines, usually of unknown extent, were also mentioned sporadically in the eleventh and twelfth centuries and at other

Dr. Andrea Kiss, Vienna University of Technology, Institute of Hydraulic Engineering and Water Resources Management, Karlsplatz 13, A-1040 Wien kiss@hydro.tuwien.ac.at

Dr. Ferenc Piti, **Dr. Éva Teiszler**, Research Group on Medieval History, Hungarian Academy of Sciences, Institute of History, University of Szeged H-6722 Szeged, Egyetem u. 2 piti@hist.u-szeged.hu , teiszler.eva@freemail.hu

Dr. Ferenc Sebők, University of Szeged, Institute of History, Department of Historical Auxiliary Sciences, H-6722 Szeged, Egyetem u. 2 sebokf@hist.u-szeged.hu

Open Access. © 2020 Andrea Kiss et. al, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-006

points in the thirteenth century.[1] The evidence for systematic research on this subject is significantly better, however, for the fourteenth and even more so for the fifteenth century. While the evidence for the fourteenth century is still somewhat limited, these contemporary reports – primarily included in legal documentation (charters) and partly in other source types (chronicles, letters, accounts) – are sufficient for a discussion of some of the trends over several years or the documentation of longer periods of difficulty and crisis in connection with the food supply.

Consequently, this paper seeks to provide the first systematic overview of documented food shortages, food supply problems, and related difficulties, crises in fourteenth-century Hungary and to discuss what may have contributed to these problems. Although compared to western Europe relatively few direct sources are available in fourteenth-century documentation concerning food shortages, dearth or famine, with a systematic investigation it is still possible to provide a first overview in this topic. The present overview also challenges the frequent assumption that medieval Hungary was not or marginally affected by the crises[2] which bore down on western Europe during this time.

In some cases, the historical accounts of problems with the food supply themselves suggest the main causes of bad harvests and food shortages. In other cases, it is possible to draw some conclusions based on the other evidence of environmental conditions of the time – namely natural weather- and climate-related (e.g., prevailing weather conditions, extreme events); geological (e.g., earthquakes); and biological hazards (e.g., pestilence and animal invasions). These natural factors combined with ongoing socioeconomic processes might have been responsible for the harvest conditions and following difficulties or even crises that sometimes lasted over several years.

This investigation discusses seven more significant cases of dearth and famine and some additional years of food-related difficulties in one or many areas of the country. The geographical focus is on medieval Hungary, but other countries of the Hungarian crown (i.e., the Croatian kingdoms) are also included when the sources mentioned these.

---

1 See Andrea Kiss, Weather and weather-related environmental phenomena including natural hazards in medieval Hungary I: Documentary evidence on the 11th and 12th centuries, in: Medium Aevum Quotidianum 66 (2013), pp. 5–37; Id., Weather and weather-related natural hazards in medieval Hungary II: Documentary evidence on the 13th century, in: Medium Aevum Quotidianum 68 (2014), pp. 5–46.

2 Scholarly literature concerning medieval Hungary has generally hypothesized that no significant, large-scale dearth or famine developed in medieval Hungary due to the low population density and the abundant resources, including the huge amount of livestock. See, for example, Péter Gunst, Hungersnöte und Agrarausfuhr im spätmittelalterlichen Ungarn (1700–1848), Agrártörténeti Szemle 26 (1984), pp. 11–18; Andrea Fara, Crisi e carestia nell'Europa centro-orientale in epoca medievale. Alcune osservazioni, in: Benito P. Monclús (ed.), Crisis alimentarias en la Edad Media. Modelos, explicaciones y representaciones, Lleida 2013, pp. 251–281.

2 Reported Fourteenth-Century Bad Harvests, Food Supply Problems and Multiannual Crises[3]

2.1 Sources

In Hungary, charters are the most important source of information on the fourteenth century, although chronicles and other types of primary sources (e.g., private and official correspondence) also give some indication of food shortages, crises and their causes. Whereas charters are only sporadically available for the period before the thirteenth century and these few contain only basic information, a slow change can be detected afterwards, especially from the second half of the thirteenth century, when charters gradually became more detailed and frequent. A real boom of charter production, however, occurred from the early 1320s (see Figure 1), during the reign of King Charles (Robert) I (1301–1342). As a result, domestic charters have an overwhelming relevance in the study of fourteenth-century food shortages and their potential environmental and socioeconomic causes. In addition, charters from outside of Hungary – either from the countries of the Hungarian crown (e.g., Slavonia, Dalmatia) or from the neighboring lands (e.g., Austria) – sometimes contain important information referring directly to the situation in Hungary, as well. Charters were issued for a variety of reasons, in a few cases also including appeals for a reductions of or exemption from certain tax types (e.g., for privileged population), but most charters were related to land transactions (e.g., selling land due to urgent need). The charter documents of the fourteenth century hardly represent all segments of the society: only those who possessed land (whether individuals or communities) appeared regularly, while charters rarely mention those without land (e.g., serfs).

A few narrative sources from the fourteenth century contain food shortage-, weather- or crisis-related information. Apart from the short but important references in the contemporary chronicle of János Küküllei, which, generally, without mentioning dates, reflect on the main natural hazards, famines, and their (primarily weather-related) causes during the reign of King Louis I (1342–1382), there is no other information relevant to this study in contemporary domestic narratives. Other primary sources, however, such as the accounts of the pope's tithe collector, as well as the correspondence of Italian ambassadors or spies in the Hungarian court, may contain useful information about the situation in the country as a whole, mainly for the second half of the century, during the reign of Louis I, Queen Maria (1382–1387) and then King Sigismund (1387–1437).

---

3 For a recent, detailed discussion of the subject, see also: Andrea Kiss/ Ferenc Piti/ Ferenc Sebők, Rossz termések, élelmiszerhiány, drágaság, (éh)ínség és okaik a 14. századi Magyarországon (Bad harvests, food shortage, high prices, dearth, famine and their causes in 14th century Hungary), in: Magyar Gazdaságtörténeti Évkönyv (2016), pp. 23–79. Whereas the paper cited contains a detailed discussion of individual sources and cases, the current paper presents an overview of the main results and further analysis of the subject.

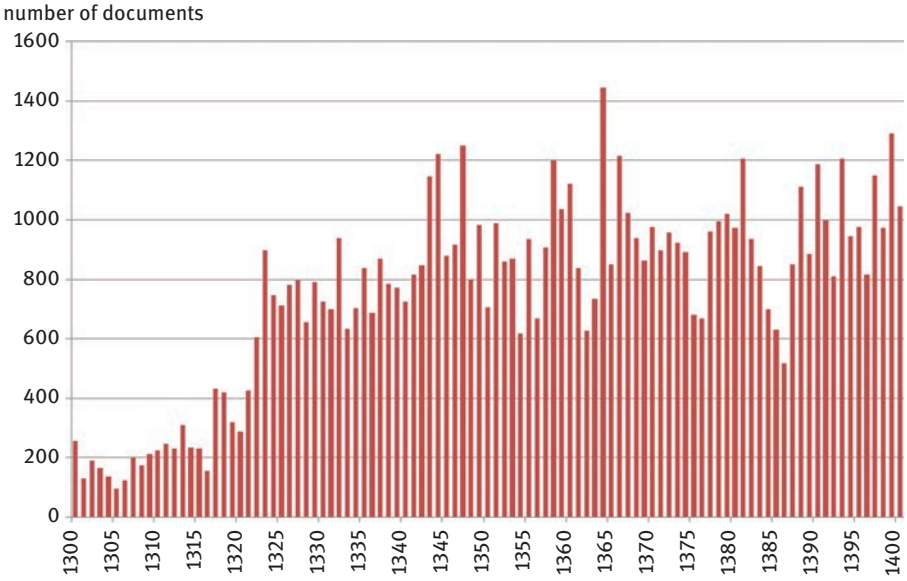

Figure 1: Number of documents per year for the 14th century, available in the Hungarian National Archives (source of data: hungaricana.hu). The great boom of documentation from the 1320s is primarily related to the increase in charters.

2.2 Terminology

Most of the source material for this study was written in Latin, but there are also sporadic cases of German and Italian – mainly in correspondence. Depending on the magnitude of food shortages and crises, the authors of the accounts in Latin used different terms, providing a useful tool for the interpretation of the severity (Figure 2a) and temporal distribution (Figure 2b) of the events described. In general, the terms themselves do not provide unambiguous information on the severity of the food shortages, difficulties, or crises described; each account must be interpreted individually. Nevertheless, even this approximate categorization can contribute – with a few caveats – to the overall interpretation.

As for food shortage problems and their severity, very little evidence is available to document the situation in fourteenth-century Hungary. The definition and meaning – based on the cases known – are seemingly not very different from (western) European interpretations[4]: *fames* (or even, *fames valida*), namely "famine," was the most severe level that appeared only twice in this century: first, prior to 1318 (1316–1317(?)) in reports from both the eastern and the western parts of the country, and then around 1348,

4 See, for example: Fritz Curschmann, Hungersnöte im Mittelalter. Ein Beitrag zur deutschen Wirtschaftsgeschichte des 8. bis 13. Jahrhunderts (Leipziger Studien aus dem Gebiet der Geschichte 6/1), Leipzig 1900, pp. 10–11; William Ch. Jordan. The Great Famine. Princeton 1996, p. 11.

presumably mentioned in the west. The account of the famine prior to spring 1318 also uses the term *inedia* ("starvation"). The mid- to late-fourteenth-century chronicler, János Küküllei, also reported on famines (*fames diversis temporibus*) during the reign of King Louis the Great, albeit without giving exact dates. Küküllei blamed the food shortage on locusts and mice which had eaten the grains and other crops, but he also listed droughts and fickle or stormy weather conditions (*aeris tempestates*) among the reasons.[5]

Caristia or *magna caristia* (e.g., 1364 and 1374) may appear both in the sense of high prices and dearth.[6] A clear reference to lack of food (of unknown severity) is *defectum victualium*; this term was used in 1321.[7] More frequently applied terms for need and shortage are *penuria*, *inopia*, and *necessitas*, whereas a more general term is *paupertas* (poverty, see Figure 2a and 2b). These last terms, often mentioned together, may not necessarily refer to a more general crisis in the area or the country itself when used in reference to individual people or families, but the severe need or poverty of communities belonging to the lower landowner classes – especially those forced to rely on the charitable institutions or had charity missions such as monasteries – may indicate a more significant long-term subsistence crisis. These segments of society were often more prone to the negative effects of a stress or crisis, meaning that their urgent need was recorded more often, and may serve as an indicator of more general, larger-scale problems.[8] Consequently, this study also interprets references to urgent needs and shortages within urban, religious, and noble communities as indicators of general difficulties in a given period.

In our present investigation, the references to *fames* and *caristia*, which suggest a more serious lack of food, are applied as direct, primary crisis indicators. The more indirect cases (third and lowest group on Figure 2a), when the terms for "need" are used in describing serious, likely multi-annual problems facing entire communities (and not only individuals!), are listed among the terms referring to difficulties that might have also been related to food supply and other problems, with the caveat that single cases alone may

5 Matthias Florianus, Chronica Dubniciense cum codicibus Sambuci Acephalo et Vaticano, cronicisque Vindobonensi picto et Budensi accurate collatum (Historiae hungaricae fontes domestici I/3.), Leipzig 1884, p. 191.

6 There are extant documents that report on the great drought and dearth of 1507 to 1508, almost two centuries later, both in Latin and Hungarian: in this case the contemporary Latin sources use the term *maxima caristia*, while the Hungarian source characterized the dearth – dated by the author to 1508 – as a time of "unspeakably high/great prices" (*mondhatatlan nagy drágaság*). For more information see, for example: Andrea Kiss/ Zrinka Nikolić, Droughts, dry spells and low water levels in medieval Hungary (and Croatia) I. The great droughts of 1362, 1474, 1479, 1494 and 1507, in: Journal of Environmental Geography 8/1–2 (2015), pp. 11–22, here p. 19.

7 Hungarian National Archives, Collection of medieval documents (hereafter HNA, DL/DF), DF 209129.

8 The documentation on difficulties of monastic communities was suggested and used as an indicator of crisis by Jordan (note 4), pp. 65–72, 76. Although he referred mainly to monastic communities in the context of discussing the difficulties of lower landowner classes, other privileged communities in somewhat similar situation may have also reacted more sensitively during the difficult years. We therefore collected and applied these other examples (e.g., urban, guest, noble communities) as well in the present investigation.

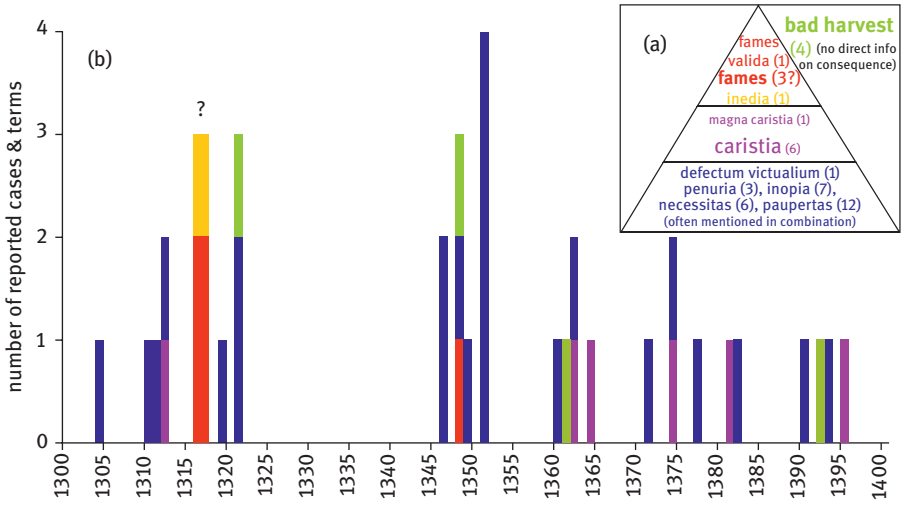

Figure 2: Applied Latin terminology for a) the severity of food shortage with the number of references; and b) the temporal distribution of the terms mentioned in contemporary documentation. Severity of terms in blue is often unknown (based on the evidence included in the present paper).

not necessarily indicate a significant regional crisis. Beyond the evidence referring to food shortages, references to failed harvests – typically to a bad grain or grape crop, but sometimes also to hay and other products – provide further evidence of food production and supply problems, even in those cases when no information directly suggests that serious food shortage problems would have followed one single failed harvest (see Figure 2b).

Based on the temporal distribution of the applied terminology (Figure 2b), the first known crisis period lasted from the 1310s into the early 1320s, with three marked sub-periods, namely the early 1310s (before and around 1312), a clearly severe period before spring 1318 (probably the years 1316 to 1317), and a probable additional shortage (of unknown severity) around the year 1321. The next period of more significant difficulties lasted from 1346 to 1351, followed by further food-supply problems in 1361 to 1362 and 1364. Other, isolated references, mainly to dearth, occasionally to poor harvests, are extant around 1373 to 1374, 1381, the early and mid-1390s.

2.3 What May Indirect Indicators Tell us About Fourteenth-Century Food Crises?

As outlined in the terminology section above, the words applied to describe certain level of difficulties are sometimes direct indicators (see Figure 2a). Other evidence, mentioned here as potential, indirect indicators (including the terms for "need" described above), may provide further useful information in detecting periods of more significant food shortage or general crisis (Figure 3). Documentation of tax

reductions, migration issues, social conflicts (e.g., social unrest or rebellion, conflicts between nations for better representation within town administration) or currency devaluation may further extend our possibilities of detecting years with difficulties or crises that might be significantly connected to food shortage in some or large parts of the country. Whereas tax reductions are more strongly related to food shortage problems, (im)migration issues, social conflicts, and, especially, currency depreciation (devaluation of the denar) may be indirect signs of more general problems.

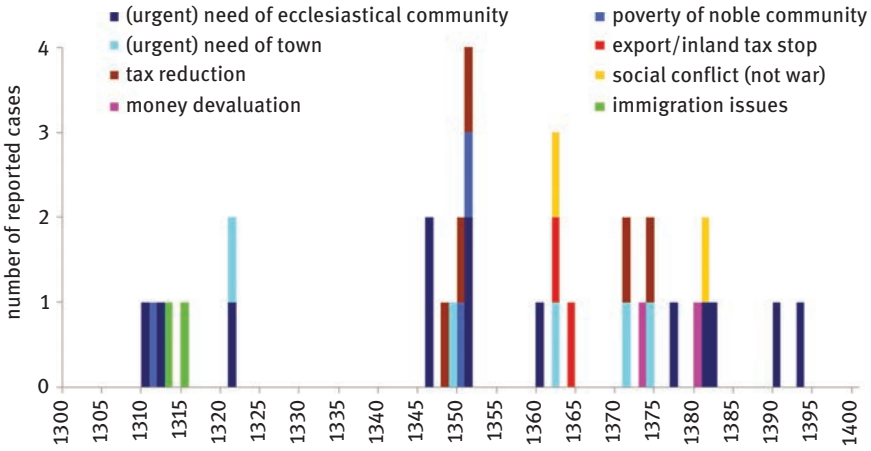

Figure 3: Indirect indicators of difficulties and/or crises in 14th-century sources (based on the evidence discussed in the present paper).

Similar to the crisis periods previously defined based on the frequency and severity of the applied terms for describing the level of food shortage problems (Figure 2), the key periods, when these indirect indicators were applied, are the early and mid-1310s with 1321, 1346–1351, 1362 and 1364, 1374 and the early 1380s.

3 Some Potential Causes: Weather-Related and Biological Factors

3.1 Weather-Related Information

Weather reports are only sporadically available for the fourteenth century.[9] Among these reports usually the ones on severe winter conditions, early and late frosts,

9 Andrea Kiss, Weather and weather-related natural hazards in medieval Hungary III: Documentary evidence on the 14th century, Medium Aevum Quotidianum 73 (2016), pp. 5–55.

convective events (e. g. thunderstorm, hail) and dry conditions may have the most relevance while discussing the potential weather-related reasons for bad harvest results in a given year. In our, fourteenth-century case no direct reference is available for convective events (Figure 4). Individual records on flooding may also refer back – albeit indirectly – to the preceding weather conditions leading up to the flood, and a higher frequency of reported flood events is often connected to periods of increased amount and/or intensity of precipitation.[10]

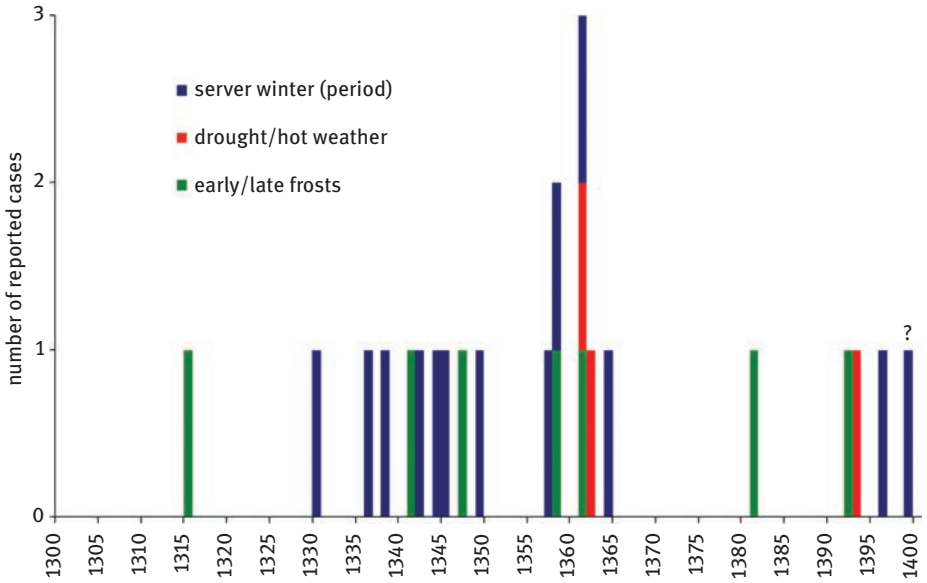

Figure 4: Contemporary evidence on weather extremes available for 14th-century Hungary.[11]

The quantity of documentary sources allows for some conclusions regarding weather and flooding from the early 1320s onwards. While references to the weather in charters are rare, in some cases there are indications of early or late frosts (and/or unusually early, late, or deep snow), references to severe winter conditions and droughts (and/or hot weather), and other conditions potentially harmful to the harvest. Out of the early/late frost cases the ones in or around 1347 and 1392 were directly connected in the documentation with negative effects on (vine) harvests. As for reported hard weather conditions observed in winter, the 1340s, for which there are somewhat more related reports, stand out. In two further cases (early 1362, 1393?) drought and/or hot weather conditions might have also affected the harvest.

10 See, for example, Andrea Kiss, Floods and long-term water-level changes in medieval Hungary, Cham 2019.

11 Source of data: Kiss (notes 9, 10), and the evidence provided in the present paper.

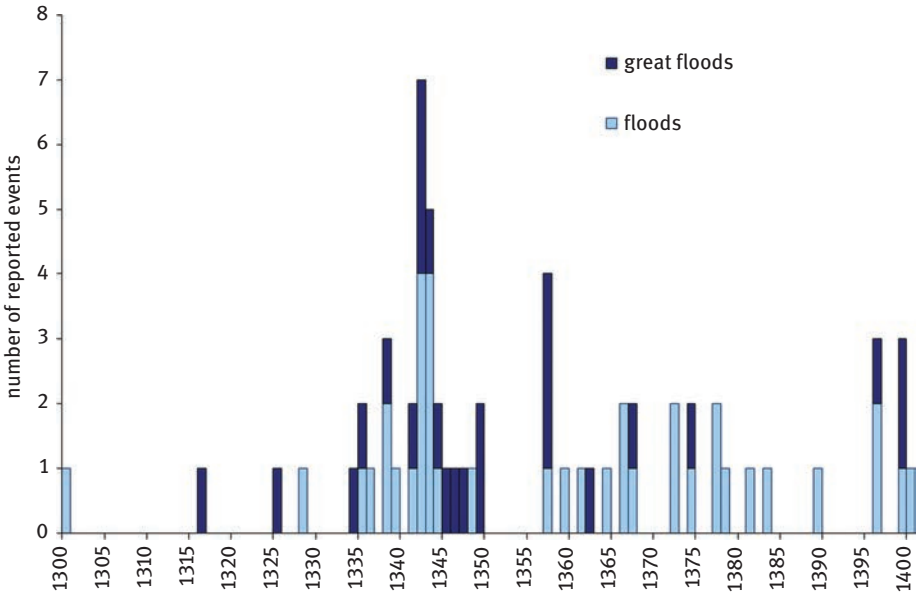

Figure 5: Individually documented flood events in 14th-century Hungary, dividing notable and great (including extraordinary) floods.[12]

As presented in Figure 5, concerning floods the charters reveal a rather exceptional period with a high number of recorded floods from the mid-1330s to the late 1340s; somewhat more floods are known again from the mid-late 1350s. Another period with more frequent and intense flooding may have started from the late 1390s and continued into the early fifteenth century.[13] The particularly outstanding years are 1342 and 1343, but rather significant flooding seems to have occurred in 1338, 1396, and 1399 as well, especially if past and/or frequent flood reports are considered in addition to the reports of current flooding. Figure 5 tallies only the individual reports of ongoing flood events, but sometimes charters also referred to past floods and frequent flooding (i.e., multi-annual flood reports): apart from one case in 1309, numerous such reports are extant for the late 1330s, the 1340s, the late 1350s, while two cases are also available in the early/mid-1360s and 1390s, respectively.[14]

12 Source: Kiss (note 10).

13 Andrea Kiss, Árvizek és magas vízszintek a 13–15. századi Magyarországon az egykorú írott források tükrében: Megfoghatók-e és mi alapján foghatók meg rövid, közép és hosszú távú változások? (Floods and high waterlevels in Hungary during the 13th-15th century in light of written sources: Is it possible to detect changes over the short, medium, and long term, and in what way?), in: Miklós Kázmér (ed.). Környezettörténet 2 (Environmental history 2), Budapest 2011, pp. 43–55. See also: Kiss 2018 (note 10).

14 Kiss (note 10).

The scarcity of reports of extreme weather and flooding themselves do not allow for direct conclusions on possible connections of weather conditions with food supply problems. Nonetheless, combining these data with the conditions reported in neighboring areas, it is possible to establish some potential connections in the individual cases.

3.2 Epidemics (plague) and Locust Invasions

Contemporary evidence is available for two further factors that might have negatively affected harvests and agriculture in general: locust invasions and epidemics (plague). As briefly mentioned above, Küküllei blamed famines during the reign of King Louis I on locusts and mice that ate the harvests. We have no other contemporary source mentioning any invasion of mice, but contemporary sources from central Europe and northern Italy include documentation of locust invasions, which spread from Hungary towards the west and southwest. Küküllei also mentioned epidemics, but his brief account makes no connection between famines and epidemics, instead blaming the famines and bad grain harvests on fickle weather, droughts, and these locust and mouse invasions.[15]

Figure 6 shows the references to epidemics in contemporary sources, as well as reports of locust invasion. In case of two, great locust invasions, namely for the ones in 1338 to 1341 and in 1363(-1366?), (foreign) contemporary sources refer to locust invasions in or coming from Hungary or from the direction of the Carpathian Basin. The great 1338–1341 invasion was also reported under the years 1340–1342 in the fifteenth-century Dubnic chronicle and the chronicle of János Thuróczy (Hungarian Illuminated Chronicle versions), while the similarly fifteenth-century Georgenberger Chronik dated this locust invasion for 1338.[16] Other years, classified here as "possible locust invasions," were when sources from northern Italy and Austria mention locust invasions in the same and/or subsequent year(s). In these cases, such as the invasions in 1309 and 1310, the rest of the years in the mid-1360s, and the possible invasion years of 1314, 1346–1347, the route of locusts also had to lead through the Carpathian Basin before reaching the eastern parts of Austria, northern Italy, and the Czech lands.[17]

15 Florianus (note 5), p. 191.

16 Imre Szentpétery, Scriptores rerum Hungaricarum. Tempore ducum regumque stirpis Arpadianae gestarum, vol. 2, Budapest 1999, p. 284; Florianus (note 5), p. 129; Erzsebet Galántai/ Gyula Kristó, Johannes de Thurocz, Chronica Hungarorum, Budapest 1985, p. 154.

17 Pierre Alexandre, Le climat en Europe au Moyen Age. Contribution à l'histoire des variations climatiques de 1000 à 1425, d'après les sources narratives de l'Europe occidentale, Paris 1987, pp. 432–433, 493–500; Dario Camuffo/ Silvia Enzi, Invasioni di cavallette e fattori climatici dal medioevo al 1800, in: Bollettino Geofisico 14/2 (1991), pp. 26–27, 31; Christian Rohr, Extreme Naturereignisse

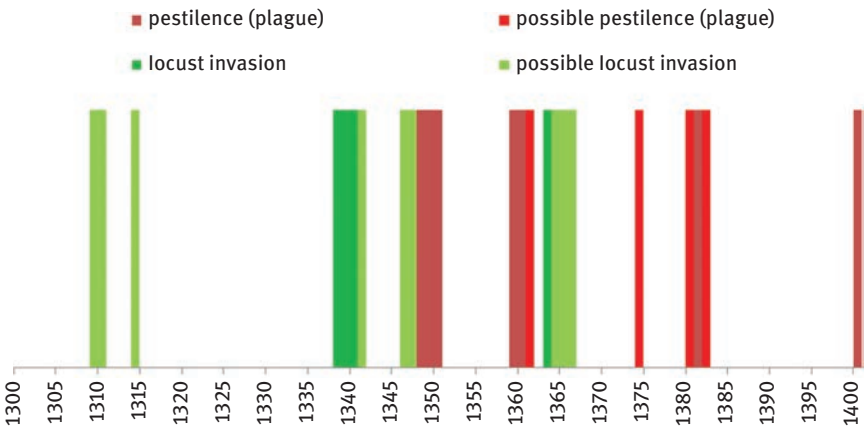

Figure 6: Documented epidemics and locust invasions in 14th-century Hungary. Invasions are classified as possible when no source refers directly to Hungary, but are assumed based on invasions reported in nearby regions during this period (e.g., Austria, northern Italy, Czech lands) where locusts usually arrive from the Carpathian Basin (based on the cases discussed in the present paper).

As previous studies have shown,[18] locusts in Austria were only destructive in a narrow zone along the track of their invasion, while areas further from their path remained practically untouched. As a result, no considerable, large-scale food shortage developed. Historical records up into the modern era suggest that the situation was different in large parts of Hungary and the Carpathian Basin. Here locusts arrived from the east, southeast, and remained over the course of several (often four to five) years in different parts of the Carpathian Basin, especially in the lowlands and larger basins in the south and east, such as central Transylvania and the southern and central parts of the Great Hungarian Plain. Locusts nested (laid eggs) over extensive areas, and the young locust larvae caused immense damage to the crops in these areas even before they were able to fly. Furthermore, local multi-annual outbreaks (even in the western part of the country) were also reported in the early modern period.[19] Still, despite the documentation available, no detailed investigations have thus far been carried out to clarify the role of locust invasions in cases of rising food prices, dearth, or even famine in the country as a whole. It is clear, however, that not

im Ostalpenraum. Naturerfahrung im Spätmittelalter und am Beginn der Neuzeit, Köln, Weimar, Wien 2007, pp. 467–468, 474. Long-term overview concerning Hungary: Andrea Kiss, A sáskajárások néhány területi és tájtörténeti vonatkozása a Kárpát-medencében (Regional and landscape historical consequences of locust invasions in the Carpathian Basin), in: György Füleky (ed.), A táj változásai a Kárpát-medencében. Történeti emlékek a tájban (Landscape changes in the Carpathian Basin. Historical memories in the landscape), Gödöllő 2012, pp. 123–132. See also: Kiss (note 9).

18 Rohr (note 17), p. 492.

19 For the latest, 800-year overview of locust invasions in Hungary based on documentary evidence, see: Kiss (note 17).

the entire Carpathian Basin was severely affected even during the most intense early modern invasions: for example, in the mountainous areas in the north and the westernmost parts of the country, these invasions followed a somewhat similar pattern as described above in Austria.

Another, even more significant factor mentioned in these sources is the incidence of epidemics (represented in Figure 6), which most probably meant plague in most cases throughout the fourteenth century: 1348–1350, 1359–1360(–1361), 1374(?), (1380–)1381(–1382), and 1400.[20] Even though the documentation allows us to identify these years as periods of plague, the gap between the early 1380s and 1400 probably means that the list is not yet complete.

Although not included in Figure 6, the cattle plague (and related loss of domestic animals) that widely affected Europe, including east central Europe, in the 1310s and early 1320s are an important further question to consider.[21] There are no extant contemporary (or near-contemporary) domestic reports about the cattle plague in Hungary, but a seventeenth-century chronicle by Caspar Hain suggests that a great many cattle died in the years around 1312.[22] Moreover, a cattle plague was reported in neighboring countries such as Austria in 1308 and the Czech lands in 1314 and 1316; it can be assumed that this cattle plague affected Hungary, as well. A similar report is known in Poland as early as 1298,[23] and, by 1317 at the latest, there are reports of cattle plague in northern Italy.[24] Two Russian chronicles mention a cattle plague in 1298 and 1309, and two Persian authors report a high cattle mortality during the reign of the Golden Horde ruler, Tohtu Khan (1291–1312),[25] so it seems that the cattle plague was present in the Golden Horde areas, east of Hungary, too.

For most of the cases in Figure 6 in which human epidemics were reported (1348–1351, 1359–1360, 1374 and 1381), there are simultaneous or, in the early 1360s, following references to food supply problems, need, shortages, or dearth. Furthermore, there are approximate, possible overlaps in the late 1300s-early 1310s, around 1346–1347

20 Jean-Noël Biraben, Les hommes et la peste en France et dans les pays européens et méditerranéens, vol. 2. The Hague 1976, pp. 439–440; his references are revised and extended in the present study on the separate case studies.

21 See, for example: Timothy P. Newfield, A cattle panzootic in early fourteenth-century Europe, in: Agricultural History Review 57 (2009), pp. 155–190.

22 Jeromos Bal/ Jenő Förster/ Aurél Kauffman, Hain Gáspár lőcsei krónikája (The chronicle of Leutscha/Levoča by Caspar Hain), Lőcse [Levoča] 1910–1913, p.12.

23 Newfield (note 21), pp. 160–161. It is also interesting that Newfield, for example, divided this particularly severe and long-term cattle plague chronologically and geographically into two periods and regions: whereas the disease was the hardest in eastern and central Europe between 1290 and 1310, the gravest reports from western and Europe are dated between 1315 and 1325. In both cases, however, central Europe was included among the affected regions.

24 Martin Bauch, Jammer und Not. Karl IV. und die natürlichen Rahmenbedingungen des 14. Jahrhunderts, in: Český Časopis Historický 115/4 (2017), S. 983–1016.

25 Newfield (note 21), p. 161.

and in the early to mid-1360s between (potential) locust invasions and food shortage or general difficulties. For the years around and after the great locust invasion of the late 1330s to early 1340s, there is no known reference in the contemporary sources to food shortages. Nevertheless, as suggested above, there is an uptick in reports of general distress in the second half of the 1340s, and in some areas even reports of more severe food shortage problems, too.

4 Bad Harvest, Food Shortage, High Prices, Dearth, and Famine: Case Studies

4.1 The triple(?) crisis of the 1310s and early 1320s: (1310–)1312, prior to spring 1318, and circa 1321

4.1.1 The Difficulties and Dearth of (1310–)1312

The first two decades of the fourteenth century were characterized by feudal anarchy and a civil war between the king(s) and opposing oligarchs. For the first decade of the century, the only direct report of general social stress is one of great poverty (associated with the war); this report came from Dalmatia and was dated to 1304.[26] Clearer reports on crisis and food supply problems are available from the second decade of the century; the first periods in which there are direct signs of a general and/or food-related crisis come around 1312 and prior to 1318.[27]

26 Mentioned as "Sclavonia" in 1304; see: Ivan K. Tkalčić, Monumenta Ragusina. Libri reformationum vol. 2. (Monumenta spectantia historiam Slavorum meridionalium 13), Zagreb 1882, p. 306.

27 For earlier studies that have already briefly addressed this problem, see: Andrea Kiss, Some weather events in the fourteenth century II. (Angevin period: 1301–1387), in: Acta Climatologica Universitatis Szegediensis 32/33 (1999), pp. 51–64. Discussing more extensively, concentrating on the (probable) crisis of the (early-)mid 1310s: Richárd Szántó, Természeti katasztrófa és éhínség 1315–1317-ben (Natural catastrophe and famine 1315–1317), in: Világtörténet 1 (2005), pp. 50–64. András Vadas, Documentary evidence on weather conditions and a possible crisis in 1315–1317: Case study from the Carpathian Basin, in: Journal of Environmental Geography 2/3–4 (2009), pp. 23–29. Whereas Szántó, based on the earlier study, took into consideration the 1312 reference to dearth, Vadas also referred to one of the (great) famine mentions (the Keserű case) prior to spring 1318. A contribution of fundamental importance to the landscape of edited source material is being made by an ongoing, multi-decadal project started in the early 1990s; this regesta-collection program of the Anjou-kori Oklevéltár (led by Gyula Kristó) series is systematically cataloging known charters (providing detailed regesta of each charter) concerning the Angevin period in Hungary between 1301 and 1387. The volumes published so far cover the years between 1301–1364.

In June 1312, the high prices or dearth (*caristia*) of the current year forced a local nobleman for selling lands in the north (Chanta and Petenye, today Čenčice in Slovakia), in the western part of the medieval Szepes county (see Figure 7).[28] There are some indirect indicators of social distress in 1310, when the Carthausians in the same county received the tithe incomes of a village from the Szepes provost due to their destitution.[29] The difficult situation might have resulted at least in part from the harassment the monastery had suffered in the preceding years. Interestingly, the nobles in this same county were also in dire straits in February 1311; at least they referred to their poverty and need when asked for and received a reconfirmation of their rights and privileges from the Palatine, Amadé Aba.[30] Finally, on July 25, 1312, the Dominican monastery on Rabbit Island (today Margaret Island in Budapest), undoubtedly one of the country's richest nunneries, declared that in their great poverty and need of "everyday things", they had had to sell one of their landed properties in Baranya county.[31] It is also an interesting fact that the seventeenth-century chronicle of Caspar Hain, compiled on the basis of some long-lost local medieval sources, reports on a three-year period of great hunger or even starvation and famine (*Hunger*), combined with the loss of cattle mentioned above. He dated the event to around the time of the great battle of Rozgony (today Rozhanovce in Slovakia), between the king and chief oligarchs that took place on June 15, 1312 in the neighboring Abaúj county.[32]

There are also reports of towns burning during this same year of 1312, for example, the royal town of Sopron in the west (reason unrecorded) and the episcopal town of Nitra in the north, which was burnt down in summer by the oligarch, Máté Csák. All these problems in the year of 1312 in Hungary is particularly interesting in the light of central European events: harvests were rather bad with dearth and famine in this year, due to great heat and drought both in the Czech lands, Austria and Bavaria.[33]

---

28 László Bártfai Szabó, Oklevéltár a gróf Csáky család történetéhez. I. kötet. Oklevelek 1229–1499 (Cartulary of the history of the count Csáky family, vol. 1: Charters 1229–1499), Budapest 1919, p. 90.

29 Georgius Fejér, Codex diplomaticus Hungariae ecclesiasticus ac civilis, vol. 8/1, Buda 1832, pp. 388–389.

30 HNA, DL 39640. Amadé Palatine (1240?–1311) from the Aba family was one of the leading oligarchs of the country in the late thirteenth and early fourteenth centuries: several counties (including Szepes) in medieval Hungary – covering the areas of the present-day eastern Slovakia, northeastern Hungary, and the Transcarpathian region in the Ukraine – belonged to his jurisdiction, and practically formed a separate province within the Kingdom of Hungary. See e.g. Attila Zsoldos, Király, oligarchák, tartományurak (The king and the oligarchs), in: História 34/4 (2012), pp. 3–6.

31 HNA, DL 40341.

32 Bal/ Förster/ Kauffman (note 22), p. 12.

33 For sources and discussion of this and other (town) fires of the century, see: Kiss (note 9). Central European parallels: Rudolf Brázdil/ Oldřich Kotyza, History of Weather and Climate in the Czech Lands I: Period 1000–1500, Zürich 1995, p. 111; Alexandre (note 17), p. 435; Curschmann (note 4) p. 207.

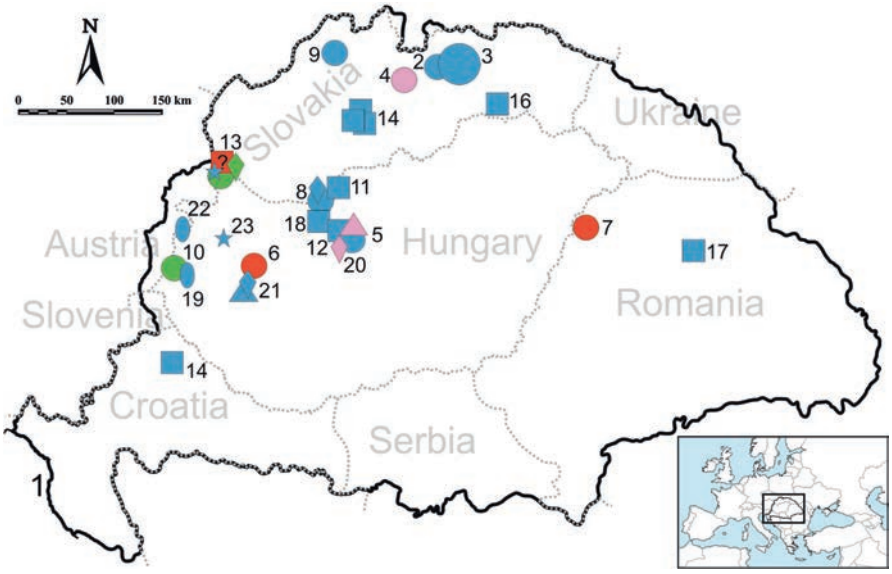

Figure 7: Locations of reported famine/starvation (red), dearth/high prices (pink) and need/food shortage, poverty (blue), bad harvest (green) cases in the 1310s to early 1320s (circle) and the late 1340s to early 1350s (rectangle), early 1360s (oval), 1370s (star), 1381–1382 (triangle), 1390s (trapezoid) in the countries of the Hungarian crown, referred in the present paper (grey: present-day countries; dotted lines: present-day country borders). Location numbers (with present-day names and countries): 1=Dalmatia (Hr), 2=Menedékkő/Lapis Refugium (Letanovce-Sk), 3=Szepesség (Spiš region-Sk), 4=Petenye/Chanta (Čenčice-Sk), 5=Rabbit/Margaret Island (Budapest-H), 6=Szőlős (Veszprém-H), 7=(Ér)Keserű (Cheşereu-Ro), 8=Esztergom (H), 9=Zsolna (Žilina-Sk), 10=Ják (H), 11=Zebegény (H), 12=Budafelhévíz (Budapest-H), 13=Pozsony (Bratislava-Sk), 14=Kapronca (Koprivnica-Hr), 15=Dobronya, Németpelsőc, Bábaszék (Dobrá Niva, Plešivec, Babiná-Sk), 16=Szepsi (Moldava nad Bodvou-Sk), 17=Dés(vár) (Dej-Ro), 18=Pilis (H), 19=Vasvár (H), 20=Buda (Budapest-H), 21=Tihany (H), 22=Máriahegy (Klostermarienberg-A), 23=Pápóc (H).

The many difficulties, combined with and at least partly caused by constant civil war, might have been the reason for the negative response to the hungry migrants coming from Alsace around 1313 that Johann von Winterthur mentions in his chronicle.[34] Neither Winterthur nor other chroniclers tell how the populace responded to other migrant groups cluding the refugees who fled to east central Europe as a result of conflicts in Lotharingia/Loraine and other areas of the German Empire in the mid-1310s; according to a contemporary source, these migrants made their living by begging.[35]

34 Chronica Iohannis Vitodurani, ed. Friedrich Baethgen (MGH Scriptores rerum Germanicarum. Nova series 3), Berlin 1924, p. 76.

35 Josef Zahn (ed.), Anonymi Leobiensis Chronicon, Gräz 1865, pp. 32–33.

4.1.2 The (great) Famine Prior to Spring 1318

In two different parts of the country, sources include reports of a long-term famine in the period prior to spring 1318 (before March and April). In the eastern part of the Great Hungarian Plain, in (Ér)Keserű (today Cheşereu in Romania) the great famine (*fames valida*), was mentioned in the context of a land purchase between close relatives: a widow who sold her land to her brother referred to past "time of the great famine" as a period that had passed by 20 April which is the date on the charter confirming the sale. The second involves a charter (issued on 19 March) from Central Transdanubia (western Hungary) which listed "unpeaceful times," starvation, and famine (*inedia*, *fames*) – when the bishop provided food and protection – as the reasons why the nobles of (Veszprém)Szőlős were subordinating themselves to the lordship of the bishop of Veszprém.[36] The considerable geographical distance[37] between the two (great) famine and starvation reports and the generalized references may suggest that large parts of the country were affected by these difficulties.

Taking into consideration the contemporary military operations and political struggles[38], the bad harvests caused by unfavorable weather in the neighboring countries (i.e., the Czech lands, Austria), the following food shortage problems in the East Central European region and, to some extent, the great floods and extraordinary rainfall that affected Austria and at least parts of western Hungary, it seems likely that the famine took place around 1316 and 1317 in Hungary, but it may have started somewhat earlier. The particular phrasing and terms used to describe the graveness of the problems in this case deserve especial emphasis: such expressions had not been seen since the great famine of the First or Great Mongol Invasion, in 1241 to 1243.[39]

---

36 Imre Nagy/ Dezső Véghely/ Gyula Nagy, Zala vármegye története. Oklevéltár. 1. kötet (History of Zala county: Cartulary vol. 1), Budapest 1886, pp. 146–147. HNA, DL 50333.

37 Aerial distance: 322 km.

38 Amongst others, see: Pál Engel, Az ország újraegyesítése. I. Károly küzdelmei az oligarchák ellen 1310–1323 (The reunification of the country: Charles I's conflict with the oligarchs, 1310–1323), in: Századok 122 (1988), pp. 89–146, here pp. 112–114, 116–118, 121, 123; Gyula Kristó, *I. Károly király harcai a tartományurak ellen 1310–1323 (The fights of King Charles I against the oligarchs 1310–1323), in: Századok 137 (2003), pp. 297–347*, here pp. 321, 325–326, 329, 331–334; Attila Bárány, Debreceni Dózsa küzdelme a bihari oligarchákkal (Dózsa Debreceni's fights against the oligarchs of Bihar), in: Attila Bárány/ Klára Papp/ Tamás Szalkai (eds.), Debrecen város 650 éves. Várostörténeti tanulmányok (The town of Debrecen is 650 years old: Urban history studies) (Speculum Historiae Debreceniense 7), Debrecen 2011, pp. 75–126, here pp. 90–92, 95, 99–100.

39 See, for example, Curschmann (note 4), p. 208; Brázdil/ Kotyza (note 33); Rudolf Brázdil/ Oldřich Kotyza/ Martin Bauch, Climate and famines in the Czech Lands prior AD 1500, in: Dominik Collet/ Maximilian Schuh (eds.), Famines During the 'Little Ice Age' (1300–1800). Socionatural Entanglements in Premodern Societies, Heidelberg 2017, pp. 91–114. For the 1241–1243 famine in Hungary, see e.g. Kiss (note 1), pp. 15–21.

4.1.3 Difficulties and Lack of Food Around 1321?

In addition to a single reference from 1319 on the need of the Chapter of Esztergom (see Figure 7),[40] there is more evidence of difficulties in western Hungary in 1321. The "unpeaceful times, "lack of food" (*defectum victualium*) and destitution forced the Ják monastery and its people (i.e., including servant population and serfs) to exchange the somewhat distant arable lands in the Rábaköz region in west-central Hungary for a nearby vineyard, a mill, a plough, six oxen and other necessities.[41] Based on the items exchanged, the monastery's decision affected its economy over the long term beyond "simple," immediate needs. As the monastery itself was located in the west, near the Austrian border, it is worth considering that the problems described may have been a reflection to some extent not only of the situation in western Hungary, but also in eastern Austria.

In the same year, a very bad grape harvest was reported in both Hungary and Austria.[42] An additional noteworthy case was recorded in the north: on July 12, 1321, the citizens of the royal town of Zsolna (today Žilina in Slovakia, see Figure 7) asked the king to renew their privileges due to their great poverty and need.[43]

As for European parallels, in this year the cereal harvest was reportedly bad in the areas further to the west, for example, in the Czech lands and the German territories. The grape harvest was reported to be bad in France, while in the German wine-producing areas 1319 and 1320 were bad years, but 1321 was already somewhat better. Generally, in terms of food shortage and dearth, 1321 appears to have been another hard year in western and central Europe.[44] England was also hit hard: the harvest of 1321 – like that of 1315, 1316, and, to some extent, 1317 – was a total failure.[45]

40 HNA, DF 237825.

41 HNA, DF 209129.

42 Continuatio Mellicensis. Chronica et annales aevi Salici, ed. Georg H. Pertz (MGH Scriptores 9), Hannover 1851, p. 511.

43 Georgius Fejér, Codex diplomaticus Hungariae ecclesiasticus ac civiles, vol. 11, Buda 1844, pp. 508–510.

44 Alexandre (note 17), pp. 442–443; Brázdil/ Kotyza (note 33), p. 112; Jordan (note 4), pp. 34–35; Rüdiger Glaser, Klimageschichte Mitteleuropas: 1200 Jahre Wetter, Klima, Katastrophen, Darmstadt 2013, p. 88.

45 See, for example: Bruce Campbell, Physical shocks, biological hazards, and human impacts: the crisis of the fourteenth century revisited, in: Simonetta Cavaciocchi (ed.), Le interazioni fra economia e ambiente biologico nell'Europe preindustriale. Secc. XIII-XVIII. Prato 2010, pp. 13–32, here pp. 20–21; Bruce Campbell, Panzootic, pandemics and climatic anomalies in the fourteenth century, in: Bernd Hermann (ed.), Beiträge zum Göttinger Umwelthistorischen Kolloquium 2010–2011, Göttingen 2011, pp. 177–215, here p. 194.

4.1.4 The probable Causes of The Multiple Crisis Period: The 1310s and Early 1320s

At least three major factors might have contributed to these economic difficulties and critical food shortages:

1) The internal war and related uncertainties were certainly an important factor during this period. From the late thirteenth century onwards, there was feudal anarchy in the country, and Charles (Robert) I's war against the oligarchs – who practically divided the country amongst themselves – lasted more than two decades in the early fourteenth century.[46] These wars and unrest affected all the above-mentioned locations around the time of the dearth and famine reports. This is quite clear in the case of the distress or crisis around 1312 and before (e.g., Battle of Rozgony), the months and years prior to spring 1318 (e.g., Battle of Debrecen, unpeaceful times),[47] and can also be one for the reasons of the local difficulties in and around 1321 in western Hungary, where unpeaceful times were mentioned in the charter of the Ják monastery.[48]
2) The few weather-related reports available from these years in Hungary do not provide conclusive information about climatic conditions during this period, but, in combination with the weather-related evidence of the neighboring countries, some conclusions can be posited. The Austrian evidence suggests that the weather conditions that caused damaging floods – for example, in 1316, or, based on a 1309 report on previous flooding, perhaps also in the first decade of the century – most probably also affected (western and central) Hungary. According to the sources for the Czech lands (and to some extent for Austria and parts of Poland), the dismal harvest in 1312 was mainly attributed to drought; in 1315, a drought until late July 1316 was followed by heavy rains, and persistent cool, rainy conditions; unusually cool, wet weather caused problems again during the growing season in 1321.[49]
3) Biological factors such as epidemics and animal invasions also contributed to these periods of economic distress. In the late 1300s and the 1310s, there was at least one locust invasion: in the summer of 1309, two contemporary sources mention a locust invasion in Kraina, Styria, Istria, and northern Italy; the Melk

46 Engel (note 38); Kristó (note 38). International scholarship sometimes refers to Charles (Robert) I as Caroberto.

47 For the latest literature on the subject, for example, see Bárány (note 38), pp. 90–92.

48 The unpeaceful times might have been (at least partly) related to the renewed controversies between the king and certain members of powerful Kőszegi family (and their Austrian allies) in the late 1310s and early 1320s. See, for example: Engel (note 38), pp. 129–130; Kristó (note 38), pp. 339–342.

49 For weather reports and flood documentation in Hungary, see: Kiss (note 9); Kiss (note 10). For Czech and Austrian weather conditions, see, for example: Curschmann (note 4), p. 208; Alexandre (note 17), pp. 434–443; Brázdil/ Kotyza (note 33), p. 111.

Annals refer to an invasion in 1310 that lasted for two years.[50] Moreover, a north Italian source reported an invasion of locusts arriving from the northeast in 1314 (see Figure 6). If the locusts in northern Italy came from the direction of the Carpathian Basin[51] and were already in northern Italy in 1309 (and maybe also in 1314), it is rather probable that locusts had arrived in the Carpathian Basin at least by the previous year(s), namely in 1308 (and maybe also in 1313).[52] As outlined above, the cattle plague represents a further potential biological hazard, and the great loss of cattle and other domestic animals across Europe likely affected Hungary in the 1310s (or maybe also in the early 1320s), too.[53] This might have led to a shortage of livestock in the Carpathian Basin some time in the 1310s.

4.1.5 The Triple (?) Food Crisis of The 1310s To Early 1320s: Some Conclusions

The extant contemporary sources suggest that there might have been two or three more difficult periods during the 1310s and early 1320s. Around (and probably even before) 1312, significant problems can be localized – together with the direct mention of dearth – to the northeastern parts of the country (Szepes county), but the report on need in central Hungary may suggest more widespread problems. The (great) famine prior to the spring of 1318 (1316–1317?) seems greater both in terms of severity and geographical scope, affecting large parts of the country. The evidence for the 1321 hardship or difficulties – mostly from the western part of the country – includes reports of a poor grape harvest, food shortages and monastic communities in dire straits, but reports of destitution in the north open the possibility that the general difficulties reached a larger spatial extent within the country.

The food supply problems of the neighboring countries provide further evidence that this was a time of economic distress or crisis in the countries surrounding Hungary, too. Areas both to the north and west of Hungary experienced severe food shortage problems around 1312(–1313) and from 1315 onwards; these difficulties – whether in the form of increased grain exports from Hungary or reduced possibilities for importing foodstuffs in times of need – might have exacerbated difficulties in Hungary, as well.

There are clear parallels in the timing of the Great Famine and long-term subsistence crisis that developed in western and central Europe in the 1310s and

50 Continuatio Mellicensis. ed. Pertz (note 42), p. 513. See also: Rohr (note 17), pp. 467–468; Camuffo/ Enzi (note 17), pp. 24–26.

51 See Dario Camuffo/ Silvia Enzi, Locust invasions and climatic factors from the Middle Ages to 1800, in: Theoretical and Applied Climatology 43 (1991), pp. 43–73.

52 See, for example, Kiss (note 9).

53 See, for example, Newfield (note 21).

early 1320s,[54] even though the exact extent of the food shortages and distress in Hungary remains unknown. The evidence for the situation in Hungary is insufficient to determine whether these isolated reports are indicators of a multi-annual, subsistence crisis with two or three peaks or simply isolated individual years of severe shortages that were localized or widespread throughout the country. Nonetheless, the information available concerning the cases in 1312 and prior to 1318 raises the possibility of a larger spatial extension of hardship and/or severe food shortage.

4.2 The Late 1340s To The Early 1350s: 1346–1351

Despite the great locust invasion in 1338–1340(-1341?), and the 1341–1344 (esp. 1342–1343) great flood peak in Hungary with hard winter period mentioned both in 1344 and 1345 (Figures 4–6), no sign of any significant food shortage is (yet) detectable in contemporary documentation.[55] The first indirect references to such difficulties come in February 1346, when poverty forced the monastic community in Zebegény to mortgage land in Baranya county. Likewise, in November, the Order of the Holy Spirit in Budafelhéviz (today in Budapest) mortgaged half of their mill due to the urgent needs of their hospital (see also Figures 3 and 7).[56]

In an application – preserved only in a book of formulae – written maybe in 1348,[57] regarding to a royal town (name not included) with significant wine production, fires and frequent frosts, that had damaged vines, induced the urban community to ask for a reduction of war (preparation) taxes due to their extreme poverty, destitution, and famine(!). In another charter, the king granted their request.[58] The edition that includes this charter suggests that the town in question is Pozsony

54 See, for example, Jordan (note 4); Emmanuel Le Roy Ladurie, Histoire humaine et comparée du climat. Tome 1: Canicules et glaciers XIIIe-XVIIIe siècles, Paris 2004, pp. 41–56. For the most frequently reference works of basic importance on the subject, see: Henry Lucas, The Great European Famine of 1315–1317, in: Speculum 5/4 (1930), pp. 343–377. Ian Kershaw, The Great Famine and Agrarian Crisis in England (1315–1322), in: Past&Present 59 (1973), pp. 3–50. For a more recent overview: Jordan (note 4), pp. 45–62.

55 See Kiss (note 9).

56 HNA, DL 76787, 3865.

57 The evidence preserved in a contemporary book of formulae and, as such, the dating was removed. Based on the contents of the charter, 1348 seems to be the most possible date for the charter's issue, as the war preparations related to the Neapolitanean campaigns mainly affected the years 1347, 1348, 1349 and 1350. The date of the charter issue most probably could not be later than 1349 due to the lack of mentioning the pestilence, but presumably it was in or short after 1347 because of the reference on the great frost). For the detailed discussion of this question see: Kiss/ Piti/ Sebők (note 3), pp. 51–53.

58 Georgius Fejér, Codex diplomaticus Hungariae ecclesiasticus ac civilis, vol. 9/5, Buda 1842, pp. 630–632.

(Bratislava-Sk), but other royal towns with significant wine production (e.g., Sopron, Kőszeg, or Buda) might just as well be the urban community in question.[59] In another charter in April 1349, impoverished serfs in the market town of Kapronca (Koprivnica-Hr) received a tax reduction from the archbishop of Esztergom. The archbishop guaranteed the reduction of their taxes until their economic situation had improved.[60]

There are at least four documented cases of impoverished, destitute communities in different parts of the country appealing for relief from financial distress in 1351. In the first case, on January 1, the hospes (guest) population[61] of Dobronya, Németpelsőc, and Bábaszék (Dobrá Niva, Plešivec, Babiná in Slovakia; see Figure 7) asked for a long-term reduction of their annual tax, because they could no longer pay the amount which King Béla IV had decreed in 1243.[62] This may mean that the economic (and/or demographic) situation of the community had changed considerably between the mid-thirteenth and mid-fourteenth century. The hospes population of Szepsi (Moldava nad Bodvou in Slovakia; see Figure 7), in the north, claimed to have somewhat similar problems; in mid-September 1351, the community was granted the free use of the nearby royal forest to alleviate their poverty.[63] In the same year, poverty and need forced the monastery of Désvár (Dej in Romania; see Figure 7) in Transylvania to

59 According to Ortvay, the town itself became a significant wine producer only from the early 16th century onwards, but wine production of town citizens had great importance already in the late medieval period. See: Tivadar Ortvay, Pozsony város története (History of Pozsony town), vol. 2/2, Pozsony [Bratislava] 1898, p. 374. It remains, of course, based on this single reference (an application in which the town citizens clearly would like to give a dramatic picture of their great problems and suffers) an open question as to whether the description of the famine is an exaggeration or reflects the actual situation. Nevertheless, as the king could have informed himself about the situation easily, it seems likely that citizens of the town were in fact experiencing such hard times in this and the preceding years.

60 HNA, DL 43553.

61 In medieval Hungary hospes (guest) population meant the invited migrants, arriving especially in the 13th century, from the west and north, mainly from German-speaking areas (esp. Saxons, Bavarians) and partly from other regions (e.g. Polish, Czechs, French, Walloons, Italians etc), settled in communities and received privileges from the Hungarian kings. Although originally they were usually foreigners, later this name was extended to all communities that received hospes rights, regardless of foreign or Hungarian origin. See, for example: Gyula Kristó/ Pál Engel/ Ferenc Makk (eds.), Korai magyar történeti lexikon: 9–14. század (Early Hungarian historical lexicon: 9th-14th centuries), Budapest, 1998, p. 273.

62 HNA, DF 269298. The last settlement was founded by (German) miners who received extensive privileges from the king in 1243. It is also possible that after several decades the productivity of ore mining declined in the area, but other reasons, such as the plague and other difficulties could as well be responsible for the decreased incomes.

63 Imre Nagy, Anjoukori okmánytár/Codex Diplomaticus Hungaricus Andegavensis, vol. 5, Budapest 1887, pp. 515–516.

sell a mill in order to repair another mill and the dam on the Maros (Mureş-Ro) river.[64] Finally, in November, the Pilis Pauliners (Central Hungary) had to sell a vineyard due to their need.[65]

The only reports which offer an explanation for the famine and financial distress are those from 1348, which mention fires and damage to the grape harvests by frequent frosts. As for other weather-related extreme events in Hungary, there are three extant reports on flooding: one report from 1346 (concerning an ongoing and two previous floods), one from 1347, and another from 1348. In addition, one report refers to a harsh winter period and flood in early January 1349, and three further flood reports – one of them about past floods – are known from spring and summer 1349.[66] As for potential parallels in weather extremes in neighboring countries, a wet and rainy year was reported in Lower Austria in early autumn 1347 with six days of heavy snow and frost devastated the grape harvest. In 1348, lightening killed many people in Carinthia, while the summer in the Czech lands was very dry with windstorms in July and a poor harvest.[67]

A locust invasion is mentioned in the Czech lands in 1346, and Italian sources for 1347 (to 1348?) also indirectly suggest an invasion around this time in the Carpathian Basin. Even more important is the plague, which is documented from late 1348 onwards. The epidemics – named the "ruinous mortality" or "pestilence" – were reported in general in different parts of the country in 1349 as well as 1350.[68] The dramatic tone in the few extant documents raises the possibility that the plague caused major problems in some areas, and this might have also had a negative effect on food production.

In conclusion, it seems that some areas may well have experienced difficulties in food production as a result of inclement weather even prior to the arrival of the Black Death. Indirect evidence – including long-term tax reductions and the dire need of

64 Kálmán Géresi, A nagy-károlyi gróf Károlyi család oklevéltára (Cartulary of the count Károlyi family of Nagykároly), Budapest 1882, pp. 203–204.

65 Nagy (note 63), pp. 527–528.

66 Kiss (note 9); Andrea Kiss, Az 1340-es évek árvizei, vízállás-problémái és környezetük, különös tekintettel az 1342. és 1343. évekre (Floods, water-level problems and the environment in the 1340s, with special emphasis on the years of 1342, 1343), in: Tibor Almási/ György Szabados/ Éva Révész (eds.), Fons, skepsis, lex, Szeged 2010, pp. 181–193, here pp. 188–189; see also: Kiss (note 10).

67 For sources and analysis of Austrian evidence: Rohr (note 17), pp. 427, 448. For the Czech areas: Brázdil/ Kotyza (note 33), p. 115.

68 On the potential locust invasion: Brázdil/ Kotyza (note 39), p. 115; Camuffo/ Enzi (note 17), p. 31. For the primary sources references to the plague: 11 December 1348: Erdélyi Okmánytár/ Codex Diplomaticus Transsylvaniae, eds. Zsigmond Jakó/ Géza Hegyi/ András W. Kovács, Budapest 2008, pp. 194–195. In 1349, charters are available for the ongoing plague epidemics, issued on March 17, April 1, October 10. Other charters are known that there was no ongoing plague in certain areas on June 7 and 25, July 2 and 11 as well as on October 7; for annual reference: June 26, 1349. See: Ferenc Sebők, Anjou-kori oklevéltár/ Documenta res Hungaricas tempore regum Andegavensium illustriantia, vol. 33, Szeged 2015, pp. 109, 138, 241–242, 249, 264, 367, 370, 417. For evidence of the epidemics in 1350: Imre Nagy/ Dezső Véghely/ Gyula Nagy, Zala vármegye története. Oklevéltár (History of Zala county: Cartulary), vol. 1, Budapest 1886, pp. 508–509.

ecclesiastical, urban, and other privileged communities – suggests increased problems and a decline in production capacities at least over some or large parts of the country by 1350 or 1351 at the latest.[69]

4.3 The early 1360s: 1361–1362, 1364

4.3.1 Bad Harvest and Special Orders in 1361–1362

In July 1361, Duke Rudolf IV of Austria, issued a charter in which he mentioned the year's bad grain harvest in Austria, the Czech lands, Bavaria, and Hungary. Moreover, the Habsburg duke added that the grape harvest that year was also bad. Due to these circumstances, as well as to fires and the plague, the town of Vienna was in dire straits at that time.[70] In the same year, famine was reported in the Czech lands, Austria, and Silesia.[71] In addition to this information on the bad harvest itself, Duke Rudolf's charter is important because it reveals certain kind of interrelations, namely that Vienna relied not only on the agrarian output of (Lower-)Austria for its food supply but, when necessary, also depended on imported foodstuffs from neighboring countries.

A document from April 1362 provides further significant information: Louis I, as king of Dalmatia, ordered the council of Ragusa (Dubrovnik-Hr) not to buy up more grain in his kingdom and territories (i.e., Hungary and the Croatian kingdoms) than necessary for their own use and also not to transport any grain abroad from the town or its territory.[72] In another case in western Hungary, dated July 1, impoverished citizens of Vasvár town had to sell the parish's mill to fund some urgently needed repairs of the church's roof.[73] In September of that same year, citizens of Trau (Trogir-Hr) in Dalmatia unsuccessfully petitioned the king for a reduction in the price of salt for help in financing the fortification around their suburb; the king referred to the ongoing and possible future difficulties within his territory (i.e., the countries under the Hungarian crown).[74]

---

69 It is, therefore, a further interesting fact that in 1351 the king renewed the old noble rights (the Golden bull from 1222), for example, regarding taxation and land inheritance and purchase, and also issued new orders (e.g., regarding land ownership related to mining and rights, regulating some parts of legal procedures). See: Dezső Márkus (ed.), Corpus Iuris Hungarici/Magyar törvénytár, Budapest 1899, pp. 171–181.

70 Peter Csendes/ Ferdinand Opll (eds.), Wien. Band 1: Geschichte einer Stadt von den Anfängen bis zur Ersten Türkenbelagerung, Wien 2001, p. 269.

71 Brázdil/ Kotyza (note 33), p. 116; Rohr (note 17), p. 443.

72 Raguza és Magyarország összeköttetéseinek oklevéltára/Diplomatarium Ragusanum Reipublicae Ragusanae cum regno Hungariae, eds. József Gelchich/ Lajos Thallóczy, Budapest 1887, p. 35.

73 HNA, DL 91578.

74 Georgius Fejér, Codex diplomaticus Hungariae ecclesiasticus ac civiles, vol. 9/3, Buda 1834, pp. 317–318.

Among the most probable reasons for the bad harvest and the prohibition of grain exports is the vicisitudinous weather conditions that affected large parts of central Europe during this time: the winter of 1361 was reportedly dry and cold, and it was followed by a hot, dry summer with frequent thunderstorms. In Hungary, reports of early spring snow in both the west and the north suggest the possibility that there was more significant (late) winter precipitation than usual.[75] Further evidence from March 1362 suggests that there was great drought in middle Dalmatia, due to which the Black Vlach (Morlach) population in the Trogir area asked the Dalmatian duke to alleviate their grazing problems (in the king's name) by permitting the use of the town's territories and water resources. Based on the early date and the potential for such problems to have developed over the long term, the drought might have started in the previous year.[76]

The difficulties mentioned here were preceded by epidemics in 1359 and 1360,[77] at least, and the somewhat increased frequency of mentions of flooding in Hungarian records may suggest that the area – like western and central Europe – received more total precipitation and/or experienced more episodes of especially intense precipitation in these years. A further interesting case on need and difficulties of an ecclesiastical community is reported in 1360, when the bishop of Győr gave a village to the Cistercian monastery of Borsmonostor (Klostermarienberg-A) located near the Austrian border, to help the monastery in its considerable need.[78] This latter case may provide an indirect evidence that, at least near the western borders of the country, in parallel to the ongoing plague epidemics, need and difficulties were documented already in 1360, a year before the best harvest report.

4.3.2 1364: A Special Year Requires Special Orders

In July 1364, the Hungarian king, Louis I, issued emergency orders in response to high prices and/or grain shortage (*caristia*) that prevailed in Hungary in 1364.[79] The charter (temporarily) abolished inland tolls for foodstuffs in the entire country and included a

75 For source evidence, see: Kiss (note 10). A further charter, issued in 1364 (HNA, DL 90540), refers to a perambulation that took place on March 10, in 1361, when land measurements were obstructed by the deep snow in Turóc county (today north-central Slovakia).

76 For more details, see Kiss/ Nikolić (note 6).

77 Sources: Lipót Óváry, A magyar tudományos akadémia történelmi bizottságának oklevél-másolatai (Charter-copies of the historical committee of the Hungarian Academy of Science), vol. 1, Budapest 1890, p. 51. Gergely Buzás/ Orsolya Mészáros, A középkori Visegrád egyházainak régészeti kutatásai (Archaeological investigations of churches in medieval Visegrád), in: Magyar Sion. Új folyam 2/44 (2008), 71–103, here p. 84. See also: HNA, DL 63074: based on the charter, pestilence prevailed in early November 1360 in medieval Turóc county. Due to this late-autumn evidence, it is possible that, similar to some of the neighboring countries, the plague or pestilence was still present in the country in 1361.

78 See Kiss (note 10). For the Borsmonostor case in 1360, see: Fejér (note 74), p. 174.

79 Fejér (note 74), pp. 408–411. HNA, DF 238823.

long list of the relevant wares: wheat, clean winter wheat, barley, oat, millet, malt, flour, bread, lentils, peas, beans, and "vegetables and all other legumes." The king ordered that surplus food, beyond personal needs for one year, be sold to those in need at a fixed, "normal" price, and he made convents and parish priests responsible for organizing and controlling these transactions. One town (Somorja; Šamorín-Sk) was tasked with sending the news to other towns. The case may also indirectly suggest notable regional differences in the quantity of stored grain and probably also in the actual harvest results within the country. In this respect, there is an interesting parallel to the 1863–1864 dearth or famine, when a catastrophic drought led to considerable regional differences in agricultural production and, as a result, in the severity of food shortage problems.[80]

Although the charter did not mention what caused the dearth beyond the problems described for 1361 and 1362, an extraordinarily severe winter – the hardest winter recorded in the fourteenth century – struck all of Europe in 1364.[81] This winter was most probably rather severe also in the Carpathian Basin: in January the deep snow obstructed perambulations in a rather extensive area in southwest Hungary, south to Lake Balaton.[82] In addition, in 1363 locust invasion, that came from the Carpathian Basin, was described in northern Italy; reports of locusts there persisted until 1366. Similar invasions are documented in German areas in 1364 and in Austria in 1366.[83] Together, these sources suggest another long locust invasion in Hungary that started by 1363 at the latest.

4.4 Late fourteenth-century dearths and food supply problems: 1374, 1381, the early and mid- 1390s

4.4.1 The Great Dearth in (1373–)1374

In 1371, a royal charter referred to the poverty and need of citizens in Pozsony (Bratislava-Sk). The king, who cited a fire in the town as a cause of these problems, granted the town a partial tax exemption to ease the difficulties. Further (tax reduction) privileges were afforded the residents of Pozsony in 1374 as the results of (the same?) fire. These charters are particularly significant in that they list the reason(s) for the problems they sought to alleviate.[84]

80 Krisztina Boa, Az 1863–1864. Évi aszály és ínség Békés megyében (The 1863–1864 drought and dearth in Békés county), Fons 19/2 (2012), pp. 161–199; here pp. 166–167, 199.

81 See, for example, Brázdil/ Kotyza (note 33), p. 116; Glaser (note 44), p. 77; Ladurie (note 54), pp. 73–74; Alexandre (note 17), pp. 493–497.

82 HNA, DL 87396. For more details, see Kiss (note 9).

83 Continuatio Claustroneuburgensis V. Chronica et annales aevi Salici, ed. Georg H. Pertz (MGH Scriptores 9), Hannover 1851, p. 736. See also: Alexandre (note 17), pp. 493, 500; Camuffo/ Enzi (note 17), pp. 33–35; Rohr (note 17), p. 475; Glaser (note 44), p. 67.

84 Georgius Fejér, Codex diplomaticus Hungariae ecclesiasticus ac civiles, vol. 9/4, Buda 1834, pp. 339, 569–572.

There is a more general evidence of widespread financial difficulties in 1374: while travelling in Hungary in the winter of 1374, the pope's tax collector justified his unusually high expenses by referring to floods and a great dearth (*magna caristia*) that prevailed during this time "in those areas." A later account of his activities also mentioned the dearth and his extraordinary expenses.[85] The report records at least one reason for his unexpectedly high travel expenses: floods. The year was also rather unusual in other parts of central Europe: the winter was exceptionally rainy, and major rivers including the Rhine, the Vltava, and the Danube rose far about their banks in late winter and early spring.[86] The ongoing epidemics that prevailed during this time in large parts of Europe may also have contributed to the high prices and dearth.[87] Furthermore, in December 1373, the new denar was introduced in Hungary, which was of a lesser value than the previous one.[88]

Bad harvests were reported throughout Europe during this year, including, for example, northern Italy, France, the Low Countries, the southern German areas and the Czech lands. In the German areas, the summer of 1373 was hot and very dry, and that was also the case at least in the first part of the summer of 1374. Furthermore, a clear food crisis with very high grain prices, dearth, and even famine prevailed in the southern part of France, northern and central Italy, both around 1369 to 1371 and in 1374 to 1375.[89]

After the 1374 dearth reference, the need of the Pápóc provosts (West-Hungary) is mentioned in 1377, when the bishop of Győr gave them the tithe of two villages. Due to the general phrasing it is not possible to declare with certainty that the donation was due to current or near-past difficulties.[90]

---

85 Rationes collectorum pontificorum in Hungaria/Pápai tizedszedők számadásai 1281–1375, ed. in chief, Arnold Ipolyi (Monumenta Vaticana historiam regni Hungariae I/1), Budapest 1887, pp. 460–461.

86 Alexandre (note 17), pp. 508–511; Brázdil/ Kotyza (note 33), p. 117; Glaser (note 44), p. 222. See also: Oliver Wetter et al., The largest floods in the High Rhine basin since 1268 assessed from documentary and instrumental evidence, in: Hydrological Sciences Journal 56/5 (2011), pp. 733–758, here p. 753.

87 Biraben (note 20), p. 440. The 1374 plague is often mentioned in Hungarian scientific literature; see e.g. István Szabó, Magyarország népessége az 1330-as és az 1525-ös évek között (Population of Hungary between 1330 and 1525), in: József Kovacsics, Magyarország történeti demográfiája (Historical demography of Hungary), Budapest 1963, p. 64. Iván Bertényi, A tizennegyedik század története (History of the fourteenth century), Budapest 2000, p. 77. Nonetheless, direct contemporary source evidence on the destruction of this epidemic is only cited regarding Zagreb (i.e. Slavonia), and not concerning Hungary. For the Zagreb evidence, see: Ivan K. Tkalčić, Monumenta historica civitatis Zagrabiae, Vol. 1, Zagreb 1889, pp. 244, 261. Zagreb experienced rather hard times around these years: after the plague, one part of the town burnt down in the next year. See also: Béla Iványi, Adatok a Körmendi Levéltárból, a pestis XVI-XVII. századi történetéhez 1510–1692 (Data to the history of plague in the 16th-17th centuries from the Körmend Archives), Orvostörténeti Közlemények – Supplementum 3 (1965), p. 60.

88 Pál Engel, A 14. századi magyar pénztörténet néhány kérdése (Some questions of the Hungarian monetary history in the fourteenth-century), in: Századok 124/1 (1990), pp. 25–93, here pp. 54, 66.

89 Alexandre (note 17), pp. 508–514; Ladurie (note 54), pp. 73–88; Glaser (note 44), pp. 67, 77, 90.

90 Fejér (note 84), pp. 168–170.

4.4.2 Dearth and Great Plague in 1381

Dearth or high prices (*caristia*) is mentioned in June 1381 in a general sense: in a case echoing those of 1312, the Dominican nuns on Rabbit Island sold a landed property in southwest Hungary (again in Baranya county) "due to the dearth, in order to buy food." The charter adds that they spent the money for food and for urgent repairs to their building.[91] It is noteworthy (cause or consequence?) that the king once again devalued the denar in 1380 (as he had already done in 1373).[92] A notable social conflict – and a probable sign of more widespread difficulties – occurred in 1381 in the royal town of Zsolna (Žilina-Sk): the Slavic (Czech) population rose up against the Germans, who possessed the majority of positions in the town council. The king finally intervened to solve the problem by ordering equal representation of the two leading ethnic groups in the town government.[93]

In the next year, in 1382, as a direct consequence of the extreme poverty and need of the Benedictine monastery of Tihany, the king ordered all landowners to give back the lands to once the monastery had possessed. With reference to the same problems and reasons, the order was repeated by Queen Mary in 1393. Apart from the possibility that the first royal order might have not been effective enough so that a second order had to be issued a decade later, the two cases are also interesting because the charters were issued in both cases one year, respectively, after a year with dearth or bad harvest mentions.[94]

The severe plague or pestilence was mainly documented concerning the year 1381, but plague was most probably present also in 1380 and 1382,[95] and might well have contributed to the dearth. By autumn 1381, the epidemic had so seriously affected some parts of the country that the king issued a charter on November 1 postponing all legal processes in the country until April 24 of the following year due to the severe prevailing pestilence.[96] Little is known about the weather and harvest conditions in 1380 and 1381 in Hungary except for the accounts of heavy snowfall in early March 1381 in the western part of the country, and of inclement weather combined with flood along the Tisza in the east.[97] Despite a severe, snowy winter and subsequent rainy March

91 Fejér (note 43), p. 475; HNA, DL 6793.
92 Engel (note 79), p. 54.
93 Erik Fügedi, A befogadó: a középkori Magyar Királyság (The receptive: the medieval Hungarian Kingdom), in: Történelmi Szemle 22/2 (1979), pp. 354–376, here p. 371.
94 1382: Fejér (note 58), pp. 589–591. 1393: Georgius Fejér, Codex diplomaticus Hungariae ecclesiasticus ac civiles, vol. 10/2, Buda 1834, pp. 92–93.
95 See, for example, HNA, DL 58617, 90953; Imre Nagy, János Nagy, Dezső Véghelyi, Codex diplomaticus domus senioris comitum Zichy de Zich et Vasonkeő, Budapest 1878, pp. 217–218. See also: Biraben (note 20), p. 440; Bertényi (note 87), p. 77. Although the available contemporary sources in Hungary only refer to the plague in 1381.
96 Fejér (note 43), p. 481.
97 HNA, DL 96560, DF 262640.

followed by a drought, the harvest was not bad in the German lands. Both England and France, however, suffered bad harvests in 1381 due to rainy weather.[98]

Connected to possible problems in Austria, another case, dated to 1385, is worth mentioning. In this year the Prior General of the Hungarian province of the Augustinian Order gave a permission to the Augustinian convents of Bruck and Marchegg in Austria, located at the eastern edge of the Bavarian province near Hungary, to ask for food in their need and difficulties also in Hungary, in locations which Hungarian monks do not usually visit with the same purpose.[99]

4.4.3 Reports of Failed Harvest, and High Prices From the Early and Mid-1390s

Apart from a royal donation to the Esztergom Chapter in their poverty and need in 1390, more direct and significant problems were documented in 1392, when cold weather damaged grapevines, while bad harvest of other products (especially hay) was also reported in Pozsony/Pressburg (Bratislava-Sk). Moreover, citizens of Pozsony appealed to the queen for a reduction in taxes due to repeated bad grape harvests and uncultivated vineyards.[100] These petitioners blamed an "invasion of cold weather/times" (*propter frigidi temporis invasionem*) for their distress, which suggests that the severe cold and hoarfrost reported on 6 October, 1392, in (Lower-) Austria also affected Pozsony. According to the Melk Annals, this cold snap caused immense damage.[101]

On 27 November in 1395, the Modenese ambassador – while staying in the Hungarian royal court – wrote to his lord, complaining about the very high prices that prevailed at that time in Buda.[102] The ambassador referred to the high prices as a reason for his wanting to return home. No information is available as to why prices in Buda were so high, and there are no other known contemporary reports from within Hungary related to this question. There is more evidence, however, on the situation in neighboring countries. Although bad harvests, mainly due to a severe drought in the previous year of 1393, were reported for 1394 in Silesia, Austria, and very probably also in the Czech lands, the Kleine Klosterneuburger Chronik suggests that the harvest in 1395 was much improved, both in terms of wine and grain. Nonetheless, the chronicler added that "bad coins" came from Bavaria during this year, which

98 Alexandre (note 17), p. 520; Ladurie (note 54), pp. 88–89.

99 Fejér (note 58), pp. 258–259.

100 1390: Georgius Fejér, Codex diplomaticus Hungariae ecclesiasticus ac civiles, vol. 10/1, Buda 1834, pp. 573–575. 1392: Tivadar Ortvay, Pozsony város története (History of Pozsony town), vol. 2/3, Pozsony 1894, p. 164.

101 Continuatio Mellicensis, ed. Pertz (note 42), p. 514.

102 Óváry (note 77), pp. 58–59.

caused problems in Austria.[103] In the area of around Mainz and Cologne, however, hail damaged both the vineyards and other crops in summer 1395, which prolonged the food shortage problems into that year, too.[104]

5 Conclusions and Outlook

By addressing primary sources that have garnered relatively little attention up until now, the present study has sought to deepen our understanding of difficulties and crises related to food supply in fourteenth-century Hungary. Despite the relative scarcity of direct and indirect documentation, it is possible to identify at least five periods of considerable or severe food supply problems and some additional shortages which were less severe:

1) 1310s–early 1320s: a) dearth in the north and need around 1312; b) (great) famine in a period prior to spring 1318 (1316–1317?); c) a lack or shortage of food in 1321.
2) late 1340s–early 1350s: widespread need, difficulties, local mention of famine;
3) early 1360s: a) bad grain harvests, export prohibitions in 1361(–1362); b) dearth resulting in emergency regulations in 1364;
4) (1373–)1374: great dearth and very high prices;
5) 1381: dearth;
6) unknown intensity of difficulties: 1392 (local problem?) and in 1395 (high prices).

Any attempt to understand what caused these food shortages and crises must consider the combined effects of multiple factors as well as the conditions of the preceding years. Apart from the period of the 1310s and early 1320s, when internal war was clearly an important factor, there are significant correlations between food supply problems and periods of human epidemics (plague), but causal relationships were not documented in detail. Moreover, there are notable overlaps with (possible) locust invasions and extreme weather including severe frosts, hard winters, floods, and droughts. The contemporary author Küküllei emphasized the direct and primary significance of inclement weather conditions, droughts, and locust (and mice) invasions in the evolution of famines.

In most cases, although sometimes with a delay, difficult years or multi-annual crisis periods in Hungary correlate with food crises documented in western and central Europe. This raises the question of whether east central Europe was more integrated in the European economy than historians often expect. This could suggest a stronger interdependence between neighboring countries, but it is also possible that significant stress, external factors, affected other parts of Europe at roughly the same time.

103 Hartmann J. Zeibig (ed.), Die kleine Klosterneuburger Chronik: 1322 bis 1428, Wien 1851, p. 9.
104 Alexandre (note 17), p. 534.

These external factors include epidemics, weather and climatic anomalies – including an increase of weather-related extremes and weather-related natural or biological hazards – and long-term social conflicts (e.g., wars). These factors sometimes affected large parts of Europe simultaneously and had different consequences depending on varying severity of the influencing factors as well as the actual local-regional socio-economic background including the conditions of preceding years.

Thomas Labbé

The Crisis of 1315–1322 in Bresse as Depicted in Manorial Rolls

Abstract: This paper assesses the severity of the crisis of 1315–1322 in the Bresse region of France. The economic documentation for this region is exceptionally good during the period in which it was under the control of the Duchy of Savoy. The accounts of many castellanies are continuously preserved from the end of the thirteenth century to the fifteenth century, which makes it possible to analyze the potential impact of the Dantean anomaly on the rural economy of this region in full detail.

To date, scholars have never studied the impact of the depression of 1315–1322 in this region. This paper presents a classical analysis of four series of manorial rolls (Jasseron, Treffort, Pont d'Ain, and Pont-de-Vaux) for the period of 1300–1330. Particular attention is given to variations in crop yields and vineyard production, as well as to price fluctuations and the indirect demographic evidence that the rolls provide.

Keywords: Harvest, prices, climate, Savoy, manorial economy, shortfall, 1315–1321

The archives of the former princely state of Savoy are famous, for they hold more than 20,000 manorial rolls dating from the third quarter of the thirteenth century up to the middle of the sixteenth century. This documentation is particularly remarkable for its precocity. While the compilation of annual manorial accounts had become a routine instrument of estate administration in England, such records going back to the 1330s are very rare in French archives.[1] However, the earls of Savoy – especially Pierre II (1263–1268) – centralized the administration of their territories during the second half of the thirteenth century and thus contributed to the creation of a remarkably advanced financial organization. This early centralization can be attributed in part

1 There is one exception: Guy Fourquin, Les campagnes de la région parisienne à la fin du Moyen Âge (du milieu du XIII[e] siècle au début du XVI[e] siècle), Paris 1964. Fourquin studied the accounts of the Saint-Denis abbey in his thesis on rural economy around Paris, but the accounts are missing for the period 1303–1320. Alain Derville more recently analyzed other accounts preserved for the same period in Picardie and Artois, see Alain Derville, L'agriculture du Nord au Moyen Âge (Artois, Cambresis, Flandre wallone), Lille 1999. There is an abundance of studies concerning English manorial accounts, see Bruce M. S. Campbell, English seigniorial agriculture 1250–1450, Cambridge 2000.

Dr. Thomas Labbé Abteilung Mensch & Umwelt, Leibniz-Institut für die Geschichte u. Kultur des östlichen Europa (GWZO), Reichsstraße 4-6, D-04109 Leipzig; Maison des Sciences de l'Homme de Dijon (USR CNRS – uB 3516) 6, Esplanade Erasme F-21066 Dijon; thomas.labbe01@gmail.com

Open Access. © 2020 Thomas Labbé, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-007

to the close political relationship between the English monarchy and the County of Savoy: Henry III married Eleanor of Provence, the daughter of Beatrice of Savoy. Pierre II served in England as a close advisor to his nephew, the king of England, during the 1240s and 1250s, and imported English administrative methods to Savoy when he himself became count in 1263. The Savoyard manorial rolls of the end of the thirteenth century and the beginning of the fourteenth century are therefore very similar to the famous and numerous manorial accounts kept in the English archives. Historians have used the records from Savoy to study the alpine rural economy going back to the 1330s,[2] but the earliest rolls have not yet been investigated except for codicological analysis.[3]

This article presents the first results of an ongoing research project devoted to the economic analysis of these early rolls, in other words, those from the late thirteenth century up to 1330. Considered from the point of view of environmental history this time span is rather short to investigate societal changes induced by adaptation strategies to climate. However, the targeted period corresponds to the onset of the Little Ice Age and the very detailed nature of the rolls make them particularly relevant to investigate the impact of a rapid climatic change on a rural economy, at least on a local scale, and to investigate in more detail the impact of the crisis of 1315–1317 in this region, which is considered to be the southernmost region impacted by this crisis.[4] This study focuses on four demesnes – Treffort, Jasseron, Pont-d'Ain, and Pont-de-Vaux[5] – located in the flat region around Bourg-en-Bresse (Dept. Ain), nearly a hundred kilometers north of Lyon. Each of these demesnes was managed by a *castellanus*, who kept careful accounts of the resources in his charge including the monetary receipts and expenditures associated with them each year. The rolls provide continuous data on incomes, the prices of cereals and wine, wages, land markets, and variations in demography during the keyperiod from 1300 to 1330. Given the preliminary stage of this research, the present paper cannot provide a broad synthesis, but will rather be limited to a description of the fluctuations of these different parameters within the period. It aims to reconstruct the mean annual fluctuation of these variables, to discuss the severity of the crisis, and to investigate the relationship between the economy and weather events.

2 Nicolas Carrier, La vie montagnarde en Faucigny à la fin du Moyen Âge. Économie et société (fin XIII^{e} – début XVI^{e} siècle), Paris 2001.

3 Christian Guilleré/ Jean-Louis Gaulin, Des rouleaux et des hommes. Premières recherches sur les comptes de chatellenies savoyards, in: Études savoisiennes 1 (1992), pp. 51–108. Sylvain Gache's short analysis of the natural risks in the castellany of Pont-d'Ain deserves mention, see Sylvain Gache, Les risques naturels et l'historien. Études, experiences et perspectives, in: Hypothèse 1999, Travaux de l'école doctorale d'histoire de l'Université de Paris I – Panthéon Sorbonne 2000, pp. 55–61.

4 William C. Jordan, The Great Famine: Northern Europe in the Early Fourteenth Century, Princetown, 1998, p. 8.

5 The rolls are preserved in the *Archives départementales de la Côte d'Or*, now abbreviated ADCO. The rolls of the castellany of Treffort have been analyzed for the period 1290–1329 (ADCO, B 10146 to B 10155; gaps in 1300–1301 and in 1310–1311); Jasseron: 1304–1328 (ADCO, B 8050 to B 8058); Pont d'Ain: 1303–1329 (ADCO, B 9014 to B 9022); Pont-de-Vaux: 1286–1318 (ADCO, B 9154 to B 9151; three gaps in 1292, 1301 and 1309).

While the rise of environmental history has led over the past decade prominent historians to consider the role of the climate on socio-economic changes,[6] French historians traditionally draw on rather sceptical seminal works[7] and remains cautious about this kind of approach. Aside from the works of Emmanuel Le Roy Ladurie,[8] which are well-known but isolated within the French historiographical context,[9] it is obvious that the research done on the economic and food problems at the beginning of the fourteenth century continues to consider – nearly exclusively – endogenous social factors responsible for these hardships. French scholarship typically assumes that the adaptive capacities of ancient societies were sufficient to counter climatic fluctuations. For example, in one recent and successful handbook (2011) on thirteenth and fourteenth centuries French history, J.C. Cassard devotes just one single sentence to climate in more than 700 pages.[10] Likewise, in Alain Derville's analysis of the evolution of agriculture in the north of France during the fourteenth and the fifteenth centuries, the only serious structural causation of food and economic issues he points out are variations in demographic trends. While he admits that weather-induced damages could play a role, for example, by triggering high mortality in 1316,[11] Derville goes so far as to label climatic factors a lazy explanation.[12] In the most recent French-speaking book about the "conjuncture de 1300", defined by the authors as a period characterized by an increasing number of food shortages all over Europe, François Menant, Monique Bourin and John Drendel, focusing

6 Richard Hoffmann, *An Environmental History of Medieval Europe, Cambridge*, Cambridge Univ. Press, 2014. Concerning the topic of this article, see especially Bruce M. S. Campbell, Nature as historical protagonist: environment and society in pre-industrial England, in: The Economic History Review 63/2 (2010), pp. 281–314 and recently from the same author: The Great Transition. Climate, Disease and Society in Late-Medieval World, Cambridge 2016. See also, for an overview of the research, Phil Slavin, Climate and famines: a historical reassessment, in: WIRES Climatic Change 7 (2016), pp. 433–447. For an early work, see Mark Bailey, *Per impetum maris*: natural disasters and economic decline in eastern England, 1275–1350, in: Bruce M. S. Campbell (ed.), Before the Black Death. Studies in the 'crisis' of the early fourteenth century, Cambridge 1991, pp. 184–207; Kathleen Pribyl, *Farming, Famine and Plague. The Impact of Climate in Late Medieval England*, Cham, Springer, 2017.

7 Édouard Perroy, À l'origine d'une économie contractée: les crises du XIV[e] siècle, in: Annales. Économies, Sociétés, Civilisations 4 (1949), pp. 167–182; Hans Van Werveke, La famine de l'an 1316 en Flandre et dans les régions voisines, in: Revue du Nord 41 (1959), pp. 5–14; Fourquin (note 1); Maurice Berthe, Famines et épidémies dans les campagnes navarraises à la fin du Moyen Âge, Paris 1984; Georges Duby, L'économie rurale et la vie dans les campagnes de l'Occident médiéval, vol. 1, Paris 1977 [first edition 1962]; Guy Bois, Crise du féodalisme, Paris 1981.

8 Emmanuel Le Roy Ladurie, Histoire humaine et comparée du climat, vol. 3, Paris 2004–2009.

9 The literature on the Middle Ages is very scarce, but the following deserves mention: Laurent Litzenburger, Une ville face au climat: Metz à la fin du Moyen Âge (1400–1530), Nancy 2015. See also for a more general overview of the relationship between environment and society, Fabrice Mouthon, *Le sourire de Prométhée. L'homme et la nature au Moyen* Âge, Paris, La Découverte, 2017.

10 Jean-Christophe Cassard, L'âge d'or capétien (1180–1328), Paris 2011, p. 569.

11 Derville (note 1), p. 81.

12 Ibid., p. 90: "explication paresseuse."

on Mediterranean regions, applied Amartya Sen's entitlement theory to explain the crisis.[13] Food shortages are then conceived as markets disruptions with very few emphasis on the synchronic climate deterioration documented through archival evidences and natural proxies.

Scholars observe however a correlation between climatic stress and food crises, but they nevertheless refuse to seriously enter it into the equation. Their skepticism about any kind of environmental determinism sometimes leads to an anachronistic distortion of medieval sources by discounting medieval people's explanation of their own situation. For example, Gérard Sivery, who specializes in economic history of France during the Middle Ages, remains very doubtful about the connection between climate and food shortages in the thirteenth century, even as he acknowledges that Matthew Paris (ca. 1197–ca. 1259), a Benedictine monk of the Saint Albans Abbey, constantly and almost exclusively pointed to climatic events to explain famine in his own chronicle.[14] More recently, Pierre Savy makes a similar statement: after analyzing the Lombardian chronicles of the thirteenth and fifteenth centuries at length, he points out that these authors attributed food shortages and famines primarily to exogenous climatic factors. Instead of taking this into consideration, however, and trying to understand medieval reactions to climate on the basis of this statement, Savy deems it an inherent limitation of the sources. From his perspective, it is evident that medieval chroniclers were only able to see food shortages as problems on the supply side and that they neglected the social dimension of demand in their analysis. Thus, he concludes simply that medieval chroniclers were unable to reflect globally on food shortages.[15]

There may be some justification for assuming that medieval chroniclers were not especially aware of economic processes and thus misconceived or overestimated the impact of climate on resources and markets. Primary economic sources, however, like the manorial rolls analyzed in the present study, refer to weather events as by far the most prominent explanation for the vast majority of fluctuations in revenue. This alone suggests at the very least that historians should reassess the role of climate in medieval perceptions and experiences.

---

13 Monique Bourin/ François Menant/ John Drendel (eds.), Les disettes dans la conjoncture de 1300 en Méditerranée occidentale (Collection de l'École française de Rome 450), Rome 2011. Recently, see also Pierre Toubert, Disettes, famines et contrôle du risque alimentaire dans le monde méditerranéen au Moyen Âge, in: Jean Leclant/ André Vauchez/ Maurice Sartre (eds.), Pratiques et discours alimentaires en Méditerranée de l'Antiquité à la Renaissance, Actes du 18ème colloque de la Villa Kérylos à Beaulieu-sur-Mer les 4, 5 & 6 octobre 2007 (Cahiers de la Villa Kérylos 19), Paris 2007, pp. 451–468.

14 Gérard Sivery, L'économie du royaume de France au siècle de Saint Louis, Lille 1984, pp. 92–93.

15 Pierre Savy, Les disettes en Lombardie d'après les sources narratives (fin XIIIe – début XIVe siècle), in: Bourin/ Menant/ Drendel (eds.) (note 11), pp. 181–206.

1 Climate and Economic Mentalities in the Early Fourteenth Century

A first step to understanding how climate influenced medieval economies is to consider contemporary medieval perceptions of the climate and its impacts on their lives. This psychological background helps to explain the coping strategies that these populations developed during a crisis. Savoyard manorial rolls from the end of the thirteenth century and of the beginning of the fourteenth century, which estate agents wrote to report to the central financial administration, are full of meteorological information which allows for some consideration of how these agents perceived climatic events. The following table (Figure 1) plots the typology of arguments that these officials used in the Bresse region to justify reduced incomes.

As one might expect, these agents often portrayed weather events as the sole cause of a decrease in income. For example, in the castellany of Jasseron, there are six occasions between 1304 and 1329 in which a deficit in the tithe revenues from grain was reported. Agents invariably mentioned climatic factors – e.g., storms or heavy rains[16] – whenever they cannot account for the expected income in the areas under their jurisdiction. In fact, during this period, stewards attributed eighty-five percent of fluctuations to exogenous climatic or ecological factors; only rarely did they explicitly refer to social factors like poverty, local epidemics, or migration. Officials in the locality of Treffort, however, seem to have been more sensitive to this reality, especially after 1320. They sometimes explained that annuities due on seigniorial lands (the *terrae tachiarum*) could not be collected in their entirety because the peasants were no longer able to cultivate them. Thus, in 1323, these *terrae tachiarum* could not deliver the normal quantity of grain because *terre remanxit uti inculte propter paupertatem gentium*.[17] This is probably a testament to a real deterioration of the peasantry's social condition in Treffort. Even in this castellany, however, where the socials aspects of the problem were seemingly obvious, the castellans privileged exogenous ecological factors to explain sixty-two percent of the instances of decreased income.

During this very same period, this region – located just at the border between the Savoy and the Dauphiné – was the site of a dramatic political struggle. The houses of Savoy and of Dauphiné were actually at war from the end of the thirteenth century until 1334. The reports submitted on economic accounts, however, rarely mention this conflict; the only reference to it is in the context of explaining the occasional destruction of a mill burned during enemies' incursions.[18]

---

16 In the roll covering the period April 1325–February 1326, the rent in wheat of the *terrae tachiarum* are said to have been reduced *propter cecitatem temporum* and those of rye *propter tempestatem* (ADCO, B 8058). For 1315, see infra note 24.

17 ADCO, B 10154 (rolls from 12 November 1322 to 8 May 1324); same argument in the following roll, concerning the crops of 1324 (ADCO, B 10155).

18 As, for example, in Pont-de-Vaux where the mill of Marcesey did not return anything between April 1305 and March 1306 *quia destructum est et combustum per dominum Johannem de Gabilione*

Castellany of Pont-de-Vaux (1300-1319)

Cause of the decrease / Type of revenue	Climate/ Ecology	War	Social factors
Mill of Pont-de-Vaux	8		1
Mill of Marcesey	2	1	
Total	83%	8%	8%

Castellany of Treffort (1300-1329)

Cause of the decrease / Type of revenue	Climate/ Ecology	War	Social factors
Cereals (terrae tachiarum incomes)	4		3
Wineyard	7		
Mills	1		
Aot (Messis avene incomes)			5
Hay	1		
Total	62%	0%	38%

Castellany of Jasseron (1304-1329)

Cause of the decrease / Type of revenue	Climate/ Ecology	War	Social factors
Cereals (*Terrae tachiarum* incomes)	6		
Wineyard	6		
Mills	1	1	
Aot(*Messis avene* incomes)			2
Hay	4		
Total	85%	5%	10%

Castellany of Pont d'Ain (1305-1329)

Cause of the decrease / Type of revenue	Climate/ Ecology	War	Social factors
Mill (destroyed in 1325)	4	1	
Wineyard (alienated in 1317)	1	1	
Total	71%	29%	0%

Figure 1: Explanations of revenue variations used by the stewards (1300–1329)

It is essential when appraising these sources that one consider the mentalities of those keeping these records: the stewards were not aimlessly providing such information. They were responsible for the reliability of the balance sheet submitted to the central administration of Savoy, and senior members of the central administration in Chambery checked the rolls for irregularities. Stewards needed arguments which could convince the auditors that the annual total they forwarded to the count was accurate. More than that, every account nowadays preserved in the archives is the clean version of the destroyed work document previously submitted to the Accounting Chamber of the county. It means that all arguments contained in the rolls have already been filtered by the administration which validated then the climate causation. Information about climate may thus appear as an administrative argument as well as an observation of actual conditions. It is clear then that estate managers and account auditors considered weather events to be one of the main reliable causations of variation in revenue, just as the chroniclers did during the same period. These sources make it clear that climate was considered to exert an important influence on the economy in the late Middle Ages.

Historians must acknowledge that whereas modern mentalities tend to draw a clear distinction between nature and culture when appraising economic causation, medieval had a more holistic perspective in which climate was a primary driver of economic prosperity or distress. It is not the role of the historians to judge the validity of these points of view but rather to bear this difference in mind to develop a better understanding of medieval societies. As Pierre Toubert argues, the study of a specific medieval perception of risks is a precondition of a useful history of food shortages[19] because – as specialists in disaster studies have long known – cultural systems are crucial elements for understanding social vulnerability and ability to respond collectively to emergencies.

2 Reconstruction of Climatic Fluctuations in the Bresse Region between 1300 and 1330

Thanks to the precision with which estate managers consistently reported to the central administration, it is possible to reconstruct a detailed picture of climatic fluctuations during this period, at least for spring and summer. This reconstruction is even more specific than accounts based on narrative sources like, for example, Pierre Alexandre's thesis.[20] The following table (Figure 2) summarizes the evidence provided in the rolls of Jasseron, Treffort, Pont-d'Ain, and Pont-de-Vaux. It contains all explicit mentions of climatic phenomena that can be found in the accounts.

milites (*because it has been destroyed and burnt by the soldiers of dominus Johannem de Gabilione*) (ADCO, B 9159).

19 Toubert (note 13), pp. 467–468.

20 Pierre Alexandre, Le climat en Europe au Moyen Âge: contribution à l'histoire des variations climatiques de 1000 à 1425, d'après les sources narratives de l'Occident médiéval, Paris 1987.

Year	Castellany of Jasseron	Castellany of Treffort	Castellany of Pont de Vaux	Castellany of Pont d'Ain	Observations based on Pierre Alexandre's thesis
1300			Flood: *aqua ita magna* (mills damaged)		
1301					
1302			Flood: *inundaciones aquarum* (mills damaged)		Flood in August Cold Summer Bad Grape Harvest (Alsace)
1303					Cold Winter Good Grape Harvest
1304					Dryness (Alsace) Storm in Summer (Paris) Bad Cereals Harvest (Paris) Good Grape Harvest (Alsace)
1305					Dryness during spring and summer (Paris) Bad Harvest (Paris)
1306		Storm in summer: mills strucked by lightning (*fulgure*) Heatwave in summer: *calorem*			Flood in Winter
1307		Heatwave in summer: *calorem*	Flood in Autumn (mills damaged)		Bad Harvest (Paris)
1308		Bad grain harvest because of a storm: *per tempestatem fuit in aliquibus locis dampnaficata* Bad grape harvest: *fuit tempestata*			Flood in Winter (Escaut) Hailstorm in Summer (Paris)

Figure 2: All climatic phenomena traceable in the in the rolls of Jasseron, Treffort, Pont-d'Ain, and Pont-de-Vaux.

Year	Castellany of Jasseron	Castellany of Treffort	Castellany of Pont de Vaux	Castellany of Pont d'Ain	Observations based on Pierre Alexandre's thesis
1309		Bad grape harvest: *fuit ibi tempestas*			Storm in October (Paris) Flood (in Tours)
1310	Flood in march and april (mills destroyed) Bad grape harvest: *deffectum vini*		Flood (mills destroyed)	Bad grape harvest because of a storm (*ovale*)	
1311					Heavy rains (Paris) Floods in Summer (Paris) Bad Harvest OF GrapeS and Cereals (Paris)
1312			Flood in autumn or winter (1312–1313) (mills damaged)		
1313		Dryness in summer: *siccitatem temporis*		Flood in winter (Jan.) (mills damaged)	
1314		Bad grape harvest: deffectum vini			
1315	Bad grain harvest: *blada perdita fuerunt in campis propter habundanciam pluviarum* Bad grape harvest Bad hay harvest	Bad grape harvest: *deffectum vini*	Flood (mills destroyed)		Floods Rain from Mid-April to End July Bad Grape Harvest (Paris, Tournai) Bad Cereal Harvest (Paris)
1316	Bad grain harvest: *deffectum bladorum* Bad grape harvest: *deffectum vini*	Bad grape harvest: *paucitatem vinorum*	Flood in december: *inundaciones aquarum* (mills damaged)	Bad grain harvest: *paucitatem blade*	

Figure 2 (continued)

Year	Castellany of Jasseron	Castellany of Treffort	Castellany of Pont de Vaux	Castellany of Pont d'Ain	Observations based on Pierre Alexandre's thesis
1317	Rain in autumn: *de secundo feno […] nichil computat quia non fuit propter pluvias*	Bad grain harvest because of a storm: *tempestatem*	Flood in autum-winter? (mills damaged)	Flood in autum-winter? (mills damaged)	
1318	Dryness from 23.06 to 01.11 (mills stuck)		Dryness in summer: *Siccitatem temporis*		Cheap wine (Paris)
1319	Bad hay harvest: *sterilitatem prati*				
1320	Bad hay harvest: *sterilitatem prati* Good grape harvest: *maior quantitas vinorum*				
1321				Flood in summer: *inundaciones aquarum* (mills damaged)	Rain in August (Paris) Bad harvest (Lyon)
1322	Bad grain harvest: *sterilitatem*	Bad grain harvest: *sterilitatem temporis*			
1323	Bad grain harvest: *sterilitatem bladorum* Bad grape harvest: *steritlitatem*	Bad grain harvest Bad grape harvest: *sterilitatem temporis*		Flood: *inundaciones aquarum* (mills damaged)	Good grape harvest (Center of France) Expensive wine (Tournai)
1324		Bad grain harvest Bad hay harvest: *sterilitatem temporis*		Flood in february: *impetum et multitudinem aquarum* (bridge destroyed)	

Figure 2 (continued)

Year	Castellany of Jasseron	Castellany of Treffort	Castellany of Pont de Vaux	Castellany of Pont d'Ain	Observations based on Pierre Alexandre's thesis
1325	Bad grain harvest because of a storm: *propter cecitatem temporis, propter tempestatem* Bad grape harvest			Flood in January: *inundaciones aquarum* (mills destroyed)	Dryness during summer (Paris)
1326					Flood in Paris (February) Dryness in Flanders Dryness in Normandy
1327	Bad grape harvest because of a storm: *propter tempestatem*				
1328	Bad grain harvest: *sterilitatem temporis*				Storms in Summer (Paris)

Figure 2 (continued)

The accounts reveal that the fourteenth century began with a succession of hot summers including two heatwaves in 1306 and 1307.[21] According to the tree-ring based climate reconstruction provided by the "Old World Drought Atlas"[22] (Figure 3), the heatwave in 1306 can be associated with a European drought, while the heatwave in the following year was part of a local drought. Bresse, however, was not negatively impacted by the drought: these years were characterized by good harvests, and the only difficulty reported was that field work was impeded during a few of the hottest days. Until 1310, in fact, it seems that grains and wine production did not suffer any general decrease because of climate. Problems were limited to local areas and typically the result of summer storms (for example, in the castellany of Treffort in 1308 and in 1309).

21 The managers of Jasseron note that, during the summer of 1306 and the summer of 1307, it was too hot to properly cultivate the vineyard.

22 I thank Stefan Ebert from the Institut für Geschichte of the Technische Universität Darmstadt, for the advices on the use of the OWDA's data.

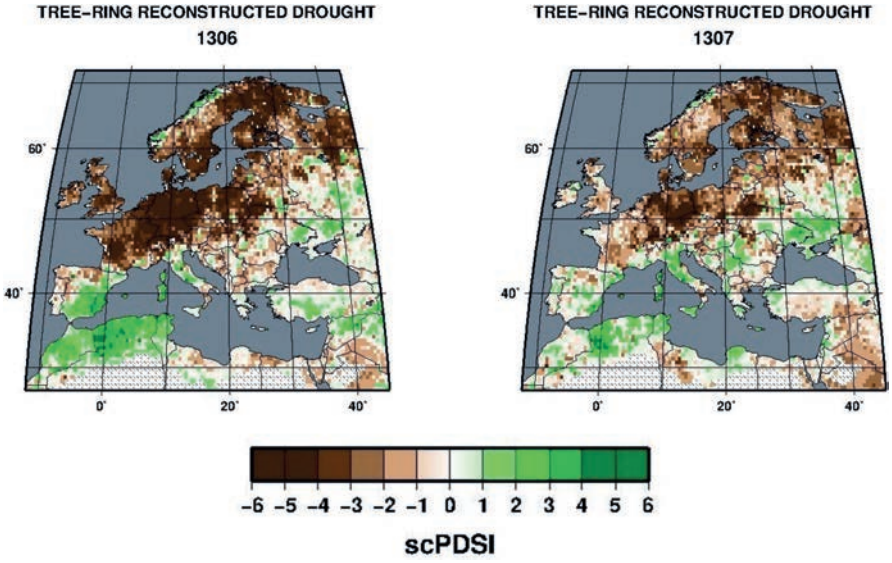

Figure 3: Reconstruction of the Palmer Drought Severity Index for the years 1306 and 1307. Brown color indicates drought, green color indicates wetness. Data: Edward R. Cook et al., Old World megadroughts and pluvials during the Common Era. Science Advances 1 (2015), pp. 1–9. https://www.ndcc.noaa.gov/paleo-search/study/19419.

The year 1310 marked a decisive turning point in the region. Heavy spring rains[23] caused disastrous flooding that destroyed all the mills in the castellanies of Jasseron and Pont-de-Vaux. The damage continued in 1311, in which harvests suffered due to rainy weather conditions even though there were fewer calamitous events. Luckily, the next two years saw an improved harvest, especially in the areas of vineyards. In 1313 the hot, dry summer was ideal for grape production.

As in the entirety of northwestern Europe, a second wave of devastation swept over the region in 1314, followed by a succession of three rainy years. In 1315, 1316, and 1317, all the managers reported a clear decrease of yields, both in wine and grains, and invariably blamed these on inclement weather. For example, in the roll covering the period from June 1315 to March 1316 (i.e., concerning the harvest of 1315), the steward of Jasseron wrote that the grain tithes of the *terrae tachiarum* decreased because *grains have been destroyed by heavy rains*.[24]

These hardships were followed by a period of recovery from 1318 to 1320. The year 1318, in fact, seems to have offered an abrupt transition after three years of heavy rains: according to the account from Jasseron, a lack of water impeded operation of

23 It might have been a storm, but the sources do not allow a definitive statement.

24 ADCO, B 8054 (roll from 23 June 1315 to 18 March 1316): *blada perdita fuerunt propter habundanciam pluviarum*.

the mills from the end of June to the beginning of November.[25] The fairly low hay harvest in 1319 suggests that this summer was unusually dry, too, but none of the stewards use the word *siccitas* (drought) in their reports for this year. The comparison with the "Old World Drought Atlas" for these years is particularly interesting, for the reconstructed Palmer Drought Index Severity shows a significant drought in 1319 and a minor one in 1318 (Figure 4), which is the exact opposite of what the accounts suggest. Further investigation is necessary to clarify the exact weather patterns of this two years. At any rate, the region prospered during the very end of the 1310s, and the harvest in 1320 was extraordinarily bountiful, especially in regard to wine. In Jasseron, the steward provided funds to buy new barrels because winery's cellar did not have enough barrels to store all the harvest.[26] This suggests that the harvest that year was practically unprecedented.

Hardships returned quickly in 1321 with new floods and a succession of bad harvests, especially in 1322 and 1323 (bad grain and grape harvest both in Jasseron and in Treffort). The estate managers' reports do not provide a clear direct link with climatic conditions, but their semantics are anything but neutral in this crucial period. From 1320 onward, the estate managers of Jasseron and Treffort almost systematically mention the *sterilitas temporis (sterility of times)* to justify the drops of revenues, without any further information. As has been suggested above, the stewards in this region seem to have been more sensitive to the deterioration of social condition of peasantry, which might explain why their argument shifted in this way. Indeed – as this study will show – the period 1321–1324 constitutes the absolute low point of the entire period from 1300 to 1330 in terms of decreasing yields and inflation. In this context, one can argue that this *sterilitas temporis* constitutes a new pattern of interpretation and reflects a shift in which economic issues were attributed other factors. After several years of citing severe climatic events as the cause for their repeated reduced yields, the stewards began to develop a longer-term perception of these cycles. The fact that they blamed these problems increasingly on 'sterility' possibly indicates a growing perception of a more global depression caused by both a decrease in the amount of land being cultivated and the general impoverishment of the population.

Finally, between 1300 and 1330, the region was struck by two waves of acute social stress (1314–1317 and 1321–1324) which came in the midst of periods of relative tranquility. However, as the drought of 1318 shows, extreme weather events occurred even during periods of relative abundance. This observation underlines and confirms

25 This event also had an impact on the functioning of the mills and on the production of hay in Pont-de-Vaux.

26 ADCO, B 8057 (roll from April 1320 to June 1321): *[…] quia maior quantitas vinorum fuit ibidem anno 1320 quam alio tempore precedento et non erat ibi tot dolia domini in quibus posset reponendum vini nisi alia dolia emerentur. ([…] because there was more wine in 1320 than any time before, and there were not enough barrels to store the harvest).*

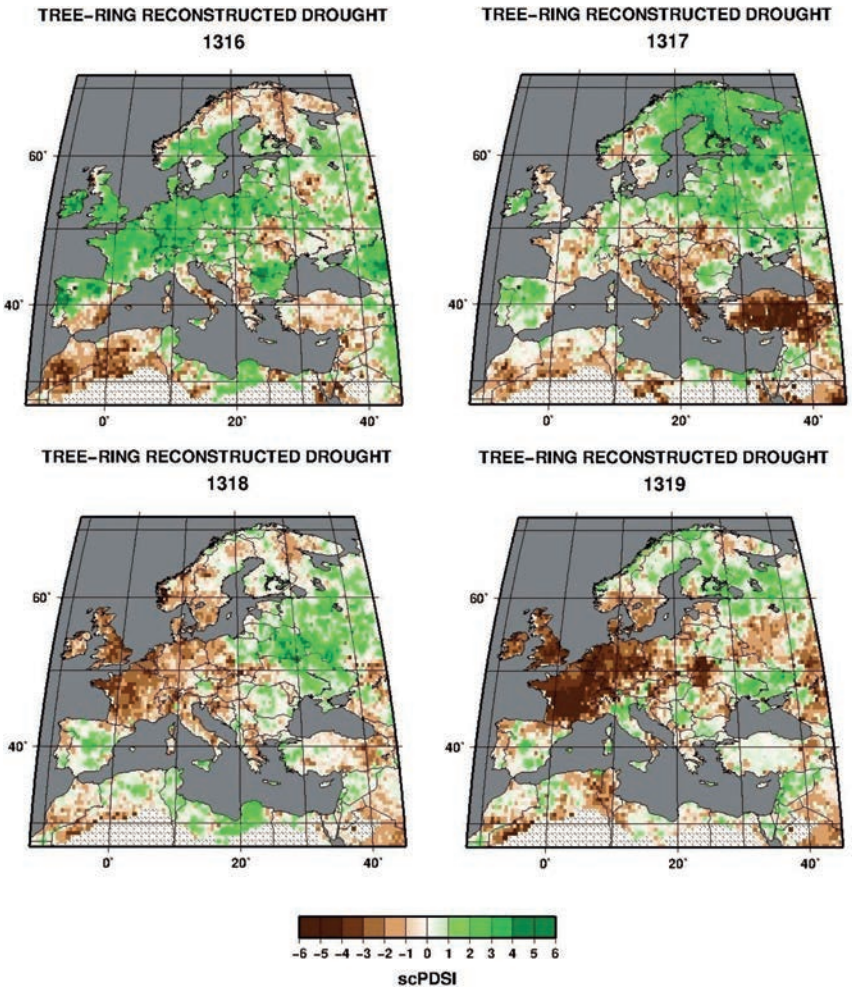

Figure 4: Reconstruction of the Palmer Drought Severity Index for the years 1316 to 1319. Brown color indicates drought, green color indicates wetness. Data: Edward R. Cook et al., Old World megadroughts and pluvials during the Common Era. Science Advances 1 (2015), pp. 1–9. https://www.ndcc.noaa.gov/paleo-search/study/19419.

at the regional level Bruce Campbell's general depiction of the period from 1315–1342 as an era of remarkable and perhaps even unprecedented instability[27]; in this twenty-eight year span, there were eleven years of bad harvests, or one year of scarcity for every three years.

27 Bruce M. S. Campbell, Physical Shocks, Biological Hazards, and Human Impacts: the Crisis of the Fourteenth Century Revisited, in: Simonetta Cavaciocchi (ed.), Le interazioni fra economica e ambiente biologico nell'Europa preindustrale secc. XIII-XVIII – Economic and Biological Interactions in Pre-Industrial Europe from the 13th to the 18th centuries, Florence 2010, pp. 13–32.

3 Reconstruction of Harvest Fluctuations

If the available documentation is detailed enough, twenty-first century historians can actually trace the impact of weather events on crop yields with considerable precision. The date for the region covered in this study actually allows for quantitative study of fourteenth-century wine and grain harvests. In Jasseron, Treffort, and Pont d'Ain, the counts of Savoy still managed parts of their vineyards at their own expense and stored the entire harvest of these *vinae domini* for their own use. The rolls thus provide fairly exactly the amount of wine produced in these vineyards. The following figure presents the raw data of annual wine yields produced by these seigniorial vineyards, coupled together with comments on the weather as contained in the rolls of the castellanies.

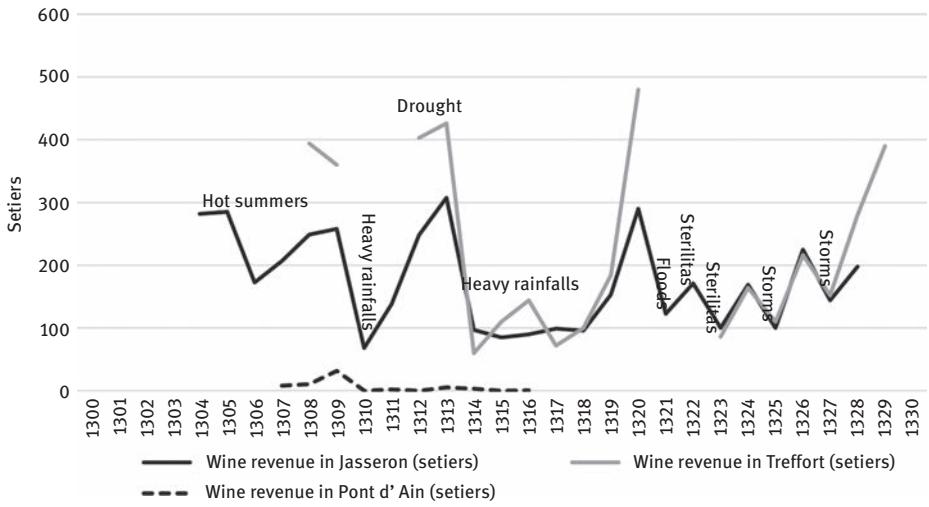

Figure 5: Real production of wine (1300–1330).

This figure confirms that climate and wine production are clearly correlated in each of these locations. Hot summers in 1306–1309 and in 1319–1320 produced good harvests, while the rainy summers of 1310 or 1314–1317 resulted in harvest failures. Continuous rainfalls in 1310 hindered the development of grape blossoms in Pont-d'Ain, dealing the vineyard there a blow from which never recovered. Further disastrous harvests in 1315 and 1316 led to the disappearance of this vineyard entirely.

As the period 1305–1309 seems to have been fairly uneventful with 'typical' harvests, it can serve as a reference point to establish average yields when these vineyards were operating at 'normal' capacity. The value 100 has been assigned to this mean for a comparison with the exact quantity of wine produced in each individual year. With this methodology, it is possible to estimate the drop of wine production in the region due to climatic issues (Figure 6). It then appears that vineyards' incomes

fell sixty to eighty percent during the period 1314–1317. Philippe Racinet has similarly calculated an eighty percent decrease in 1317 for the vineyard of the Benedictine priory of Saint-Arnoul located north of Paris,[28] a region where the crisis is known to have been very serious. From the point of view of wine production, the gravity of the situation seems to have been as worrying in Bresse. The damages range from thirty to sixty percent of their normal values during the period 1321–1325.

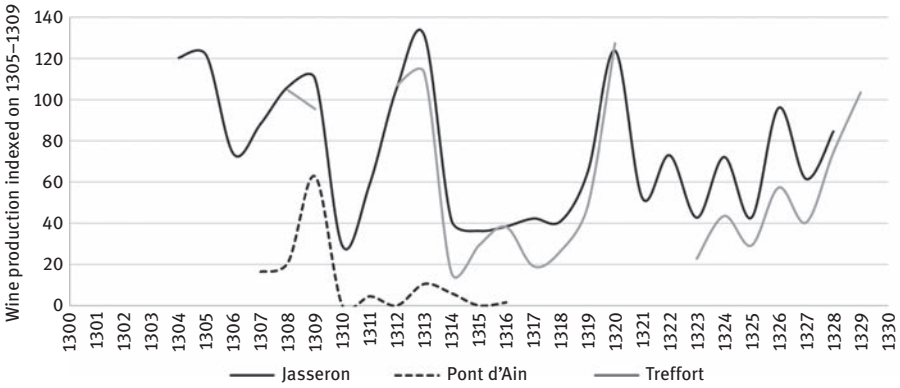

Figure 6: Indexed production of wine (1300–1330).

Such a reconstruction of grain yields is more challenging. Like landlords in many other parts of western Europe, the counts of Savoy did not directly cultivate their croplands anymore in the early fourteenth century, which makes it impossible to determine the exact yields of particular fields, as can be done with vineyards. However, the rents collected on seigniorial lands called the *terrae tachiarum* do provide indirect but reliable information that more or less accurately reflects fluctuations in yields. These *terrae tachiarum* rents were a holdover from an era when peasants had been required to cultivate seigniorial lands for their lord. By the beginning of the fourteenth century, this labor service had been transformed into a kind of tithe: the estate managers leased these lands to peasants against an annual rent in kind, generally a portion of the crops in wheat, rye, and oats. Now, as Figure 7 and 7bis indicate, this rent was variable and proportional to the overall returns of the fields. In the demesnes of Treffort and Jasseron,[29] the *terrae tachiarum* annuities actually run parallel to one another. Besides, the fluctuations in this rent seems closely linked to climatic factors, though not as closely as the figures for vineyard production. Indeed, while the variation in rents paid depended primarily on crops production, it was also the result

28 Philippe Racinet, Les maisons de l'ordre de Cluny au Moyen Âge. Évolution et permanence d'un ancien ordre bénédictin au nord de Paris, Louvain, Bruxelles 1990, p. 73.

29 There were no *terrae tachiarum* annuities in Pont d'Ain and Pont-de-Vaux.

of a process of negotiation between the estate managers and the tenants who had to petition for a reduction. The administrative proceedings can therefore delay the reduction to the year after a failed harvest, as was surely the case in 1315 in Treffort. Nevertheless, a general decrease of these rents between 1314 and 1317 and then again between 1321 and 1324 is clearly visible in both castellanies.

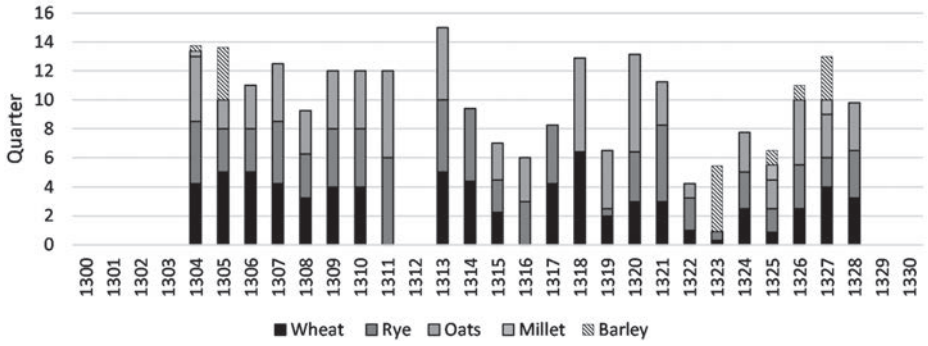

Figure 7: Real incomes of the terrae tachiarum rent in Jasseron (1300–1330).

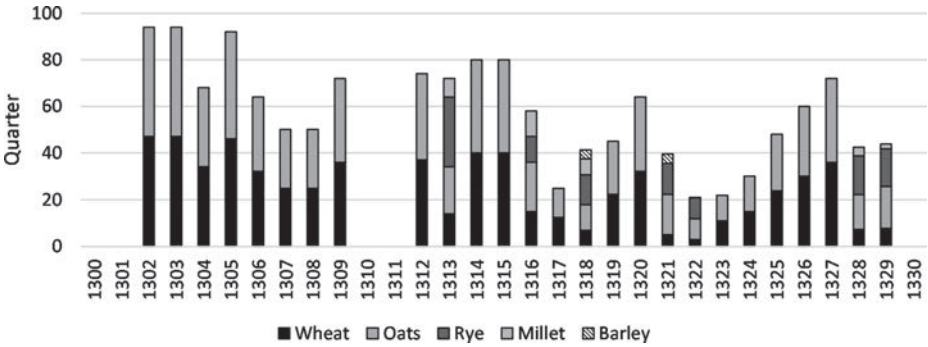

Figure 7*bis*: Real incomes of the *terrae tachiarum* rent in Treffort (1300–1330).

Assigning the value 100 to the mean value of these rents for the period 1305–1309 results in an estimation of reduced grains yields in the region of forty to sixty percent in 1314–1317 and of forty to seventy percent in 1321–1325 (Figure 8).

4 Price Fluctuations and Social Impacts

Many studies have demonstrated how grain and wine prices in pre-industrial societies were a function of supply, i.e., of agricultural yields. In other words, a failed harvest caused inflation. The manorial rolls of Bresse contain a section called *venditiones*

Figure 8: Mean cereals yields (1300–1330).

(sales) that includes an annual estimation of price per *setier*[30] of wine and various grains (wheat, rye, and oats). This abundance of information about grain prices provides continuous datasets for the entire period of 1300 to 1330 in three castellanies (Jasseron, Treffort, Pont-d'Ain). Every year, the estate managers converted every instance of revenue in kind into a monetary value before sending the final balance sheet to the central administration in Chambery. The use of this data does present some methodological problems that deserve mention: It is impossible to determine for sure if the foodstuffs were actually sold by the estate managers, and, if so, how they were sold. Thus, we do not know if the prices indicated in the *venditiones* reflect the market exactly. However, as the wheat and rye prices in the three different locations examined are perfectly correlated, a case can certainly be made that the *venditiones* reflect the actual market to at least a certain extent. This assumption is further reinforced by the overall high volatility of the prices. On the other hand, the price of chicken and the price of bread recorded in the *venditiones* were clearly fixed by the custom and were consequently the same every year. Figure 9 plots the relationships between variations in grain yields in Jasseron and Treffort and the average price of the *setier* of wheat[31] obtained by aggregating the data from the castellanies of Jasseron, Treffort, and Pont d'Ain.

This figure confirms the strong inverse correlation that is characteristic of the relationship between yields and prices in the medieval economy. The first drop in grain yields in Bresse led to an inflation rate close to ninety percent between 1314 and 1317. Then, after a rapid fall in 1318 and a stabilization phase of moderate prices until 1320 (good harvests), prices rose abruptly again in 1321 and 1322 as a direct consequence of

30 Regional unit of measurement

31 Data about wine prices is unfortunately too patchy to compile a continuous dataset.

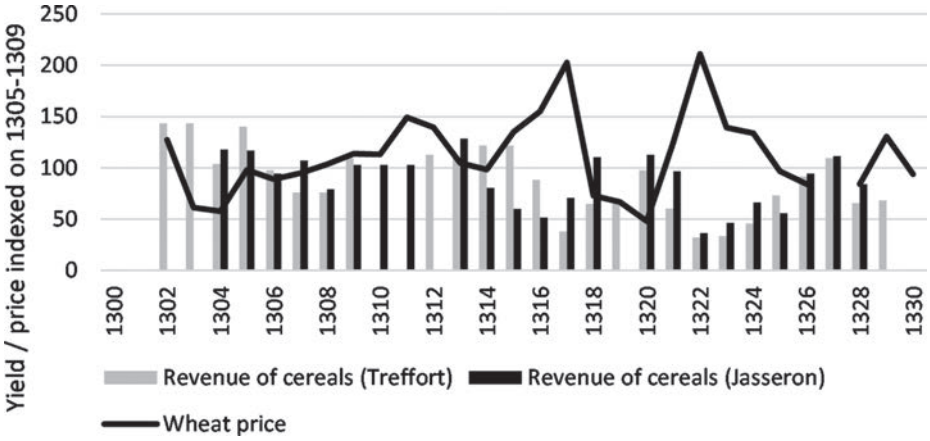

Figure 9: Mean cereals yields and mean wheat price (1300–1330).

disastrous harvests. Cereal prices more than doubled, reaching their highest level for the entire period of 1300 to 1330 in 1322.

Though these numbers are impressive, inflation in rural Bresse was much lower than what has been observed in urban areas in northern France, Flanders, or England, where the crisis of 1315–1322 was even more dramatic. In the city of Béthune, for example, Alain Derville found a five-fold increase in prices,[32] while, according to another study, prices in Bruges tripled during this time.[33] Ian Kershaw observed that corn prices more than tripled in South England in 1316,[34] which is quite similar to the data compiled by Campbell et al. concerning the grain market in London.[35] Not only the ratio, but also the length of the inflation is not exactly the same as what happened in these northern urban markets. While prices in Bruges and London prices peaked in 1316 and then started to decrease the following year, they continued to rise in the Bressian demesnes even after the harvest of 1317. This delay might highlight a difference in the ability to cope with price inflation that distinguishes urban and rural economies. Authorities in Bruges or London actually imported large amounts of grain from the Mediterranean region in 1316 to stem the inflation[36]; such a response was surely impossible in rural locations. It is certainly also true, however, that the

32 Derville (note 1), p. 81.

33 Van Werveke (note 7), p. 10.

34 Ian Kershaw, The great famine and agrarian crisis in England, in: Past & Present 59 (1973), pp. 3–50, here p. 8.

35 Bruce M. S. Campbell et al., A Medieval Capital and its Grain Supply: Agrarian Production and Distribution in the London Region c. 1300 (Historical Geography Research Serie 30), London 1993, p. 202. Coming from the city's assize of bread and given in pence per bushel, these data concerns wheat prices: 7,87 (oct. 1304), 8,75 (oct. 1305), 8 (oct. 1306), 9 (oct. 1307), 12 (oct. 1309), 25,5 (oct. 1316), 15 (oct. 1317).

36 Van Werveke (note 7), pp. 12–13.

shortfall was less existentially critical in the rural settlements of Bresse than in northern urban centers, so that there was no absolute need to take such drastic measures against inflation.

Indeed, living standards do not seem to have been critically threatened in 1315–1317 in the region of the present study. Although the rents due on some houses suggest that some displacement of the population occurred, there is no evidence of starvation or an increased mortality rate in the four rolls analyzed. The managers neither mention such extreme hardships nor describe anything beyond the aforementioned impoverishment of the population. In addition, the sparse evidence about the displacements of the population, cannot be correlated in all the castellanies and the fluctuation of the rents involved is difficult to estimate at this stage of the research.
In Jasseron, for example, the rents given seem to have varied on each house in the different locations of the castellany. In the village of Ceyzeriat, each house had to give one chicken and one loaf of bread. Yet, the revenue of each of these different rents indicates a different number of houses, which probably reflects the different privileges involved in the calculation of these different taxes. However, within each category, the number of house remains stable, indicating that there was no desertions of entire houses in this village (Figure 10). In Treffort, to the contrary, the rent in oats due on each house located *outside the free territory of the city* indicates that some movement of population occurred right after 1315 (Figure 11). In just two years, tenants left two thirds of the houses, and many of these remained empty until at least 1329. Despite the fact that the rolls do not explicitly mention what caused this desertion,[37] it seems likely to be associated with the harvest failure of 1315–1317. There is no evidence to suggest that these people died, but it is impossible to determine what happened to them.

Finally, one last parameter can shed some light on the social disorganization that afflicted the region in the wake of the harvest failure and inflation from 1315 to 1317 and 1321 to 1324. Indeed, the accounts of holdings being surrendered in Jasseron and in Treffort consistently reflect a visible disturbance of the rural society during these periods. In these two places, the land market was evidently more volatile from 1317 to 1319 and from 1323 to 1324 (Figure 12 and Figure 12bis): two to three times as many holdings changed hands in these periods as in an average year or the early fourteenth century, suggesting that small tenants had to sell off some lands to overcome the hardships. This rate is even close to what has been observed in Hertfordshire and Cam-

37 The roll of 1316–1317 explains that *computat minus [...] pro octo hospiciis que vacant et domus corruerunt ad presens (reckons less [...] for eight houses that remain empty, and buildings actually fall down)* without giving more precision (ADCO, B 10153); we find in the roll of 1317–1318: *computat minus solito quam in computo precedent [...] pro undecimae hospiciis qui vacant, de quibus plures corruerunt* (*reckons less than in previous account [...] for 11 houses that remain empty and partly felt down*) (ADCO, B 10153).

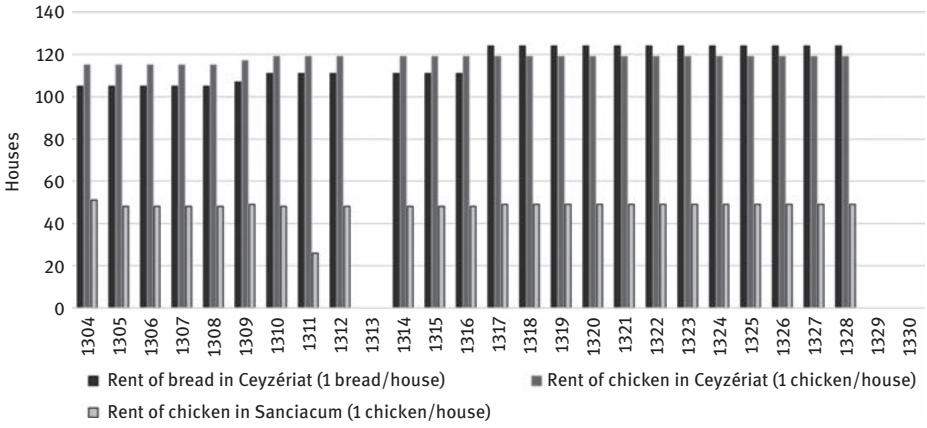

Figure 10: Variation of rents bearing on house in Jasseron (1300–1330).

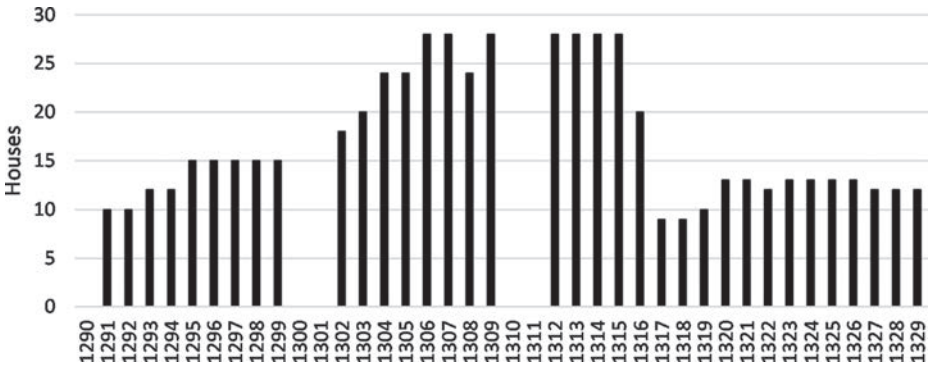

Figure 11: number of house located *extra franchesiam Trefforti* returning the rent in oat (1290–1330).

bridgeshire[38] or Norfolk.[39] The peaks of this turnover, however, did not occur at the same time in England and in Bresse. In England, the number of transactions rose strikingly right after 1315 and 1321, a direct sign of the urgent need of money to buy food after the bad harvests. In Jasseron and in Treffort, the land market only changed after 1317 in response to the first wave of bad harvests, and in 1323 in response to the second wave. This suggests that the living conditions were less severely affected in Bresse, where the population was able to withstand the first failed harvest and even able to cope with one or two years of penury. As it has already been said, the main issue in Bresse was the impoverishment of the peasantry, which did not face the real survival

38 Kershaw (note 40), p. 38.
39 Jordan (note 4), p. 100.

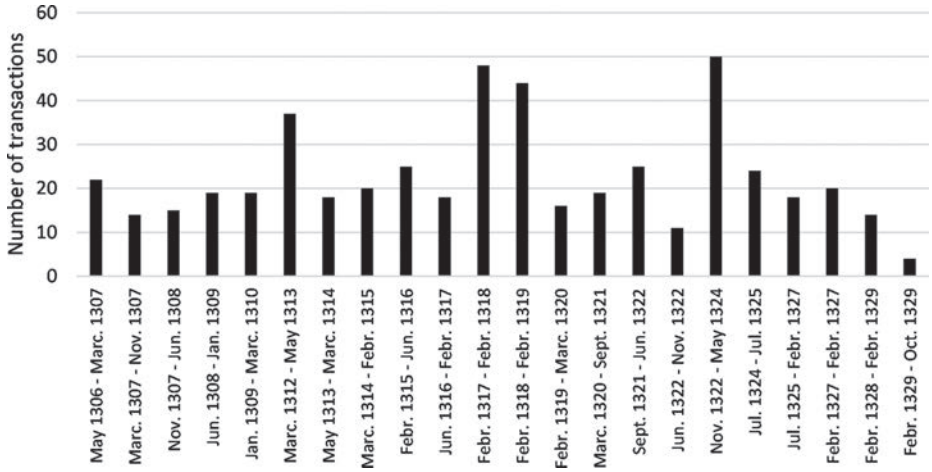

Figure 12: Surrender of holdings in Treffort (1307–1330).

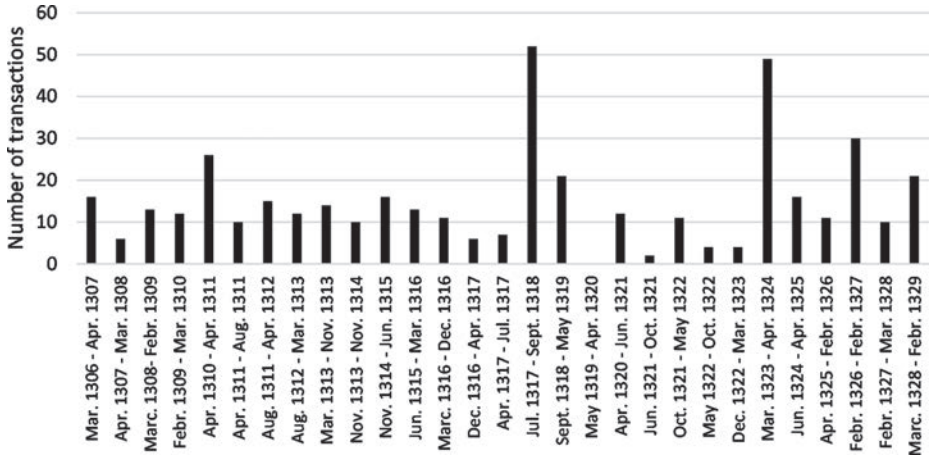

Figure 12*bis*: Surrender of holdings in Jasseron (1307–1330).

challenges of their counterparts in northern Europe. It was only back-to-back harvest failures and the resulting years of inflation that finally led to visible social distress.

5 Conclusion

The analysis of the manorial rolls of four castellanies of Bresse, though too incomplete to give a comprehensive view of the problems, clearly indicate that the classical fluctuation of the Dantean anomaly also contributed to important issues in this

region, which scholars have considered the southernmost region impacted by the crisis of 1315–1322. The quantitative documentation at our disposal, apart from a body of weather observations which explain the variation of revenues in part, indicates a drastic drop of wine production of up to eighty percent after 1315, and a drop of grains yield that can be roughly estimated to fifty percent of the normal yields at the very beginning of the fourteenth century. In terms of price fluctuations, an economic downturn started in 1310, when the crisis worsened in two waves of inflation: a first one from 1314 to 1317, which the estate managers attributed to heavy rainfalls, and, after a temporary recovery, a second and more intense one from 1321 to 1325.

This documentation shows a very direct impact of the weather on local society. The social repercussions of the deteriorating climatic conditions are nearly immediately evident, both in terms of declining agricultural output and of fiscal adaptation. The demographic impact, which appears not to have been particularly dramatic, highlights the resilience of these rural communities in dealing with variations in the weather. Despite this resilience, a succession of failed harvests obviously made local society increasingly sensitive to calamity. This is the most important impact of this period's climatic deterioration on this society: the repetition of bad weather events in such a short period weakened its resilience and made it more and more vulnerable to the next problem that arose. That explains why the question of poverty only emerged in the rolls in the 1320s and not before. This led to the accountants – and then of the central administration of the county of Savoy – being more attuned to the social issues of the peasantry.

Tana Li

The Mongol Yuan Dynasty and the Climate, 1260–1360

Abstract: Although climate science suggests that the Yuan era in China witnessed a number of natural disasters, historians have yet to consider such data in their accounts of the Yuan dynasty's rapid fall. The dominant view largely blames their quick demise on extravagant grants to the Mongolian aristocracy and army and excessive expenditures on war, but even a perfunctory analysis of the data reveals these behaviors had effectively disappeared decades before the dynasty collapsed. This study highlights two neglected climate-related factors that played a much greater role in the dynasty's demise than has been previously established.

First, the sheer size of the Yuan Empire, which included the territories of modern central and southern China, along with the Mongolian steppe to its north and other territories to the northwest and northeast, made it vulnerable to many different sorts of climatic disasters. When a series of such catastrophes struck, the emperor Kublai extended the ancient Chinese Confucian policy of *huang zheng* (disaster relief) to all parts of the empire. The situation became so dire, however, that this official relief across such a vast area consumed as much as one-third of government revenue in bad years. Although well-intended, the policy ultimately undermined both the wider economy and the government finances.

Second, serious flood damage to the Yangtze delta occurred at a critical moment when this rich granary was badly needed to support other stricken areas. Four-fifths of the Yuan population lived south of the Yangtze, and the area's production of grain, cotton, silk, and salt were all crucial for government revenue and general wealth accumulation. Typhoons and floods here ultimately cost the court far more than its support for hard-pressed Mongolian refugees. These disasters drained increasingly scarce resources from other areas while negatively impacting the dynasty's capacity to support the empire as a whole. In the end, it was the pressure of a major disaster here that sparked the revolt that overthrew the Yuan.

Keywords: Mongols, Yuan China, natural disasters, 13th century, 14th century

The Mongolian Yuan dynasty (1271–1368 CE) was unique in Chinese history: while it ruled over the largest territory in Chinese history, it was much shorter lived than

Dr. Li Tana, China in the World Centre College of Asian and Pacific Studies The Australian National University tana.li@anu.edu.au

Open Access. © 2020 Li Tana, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-008

all but one[1] of the other major dynasties, which each lasted for at least two hundred years. Why did the Yuan disappear so quickly? Scholars have cited various factors to explain this phenomenon, including, most significantly, Mongol discrimination against Han Chinese, the over-circulation of paper currency, and excessively corrupt officials. Very little credit has ever been given to exogenous factors like changes in the climate. Yet, as this paper will show, exploring the connections between the environmental and societal changes during the crisis of the fourteenth century can provide vital new insights into the demise of the Yuan dynasty.

This viewpoint recognizes climate as a major factor in the downfall of the Yuan dynasty**.** The Yuan had had the misfortune to found their dynasty in an age of great climatic instability: the earth was in an active seismic cycle,[2] weather patterns were changing quickly, and climatic disasters were becoming more frequent. These factors exerted tremendous pressure on China's ecological, economical, governmental, and social structures, creating a precarious situation for the ruling dynasty.[3] Bruce Campbell's recently proposed concept of a dynamic socio-ecological system is particularly relevant to our analysis of the fate of the Yuan dynasty. Campbell enumerates six core components: climate and society, ecology and biology, microbes and humans, none of which existed in isolation. Changes in any of them could "disturb the equilibrium and initiate a system shift from one dynamic socio-ecological regime, balancing and adjusting itself within one set of bounds, to an alternative socio-ecological regime varying within a quite different set of bounds."[4] This is what seems to have happened to the Yuan Empire in the fourteenth century. Historical records of this era are filled with natural disasters, especially between 1300 and 1359. This period witnessed a surge in every imaginable type of natural disaster all over the country: frequent super typhoons along the southeastern coast; recurrent floods of both the Yangtze and Yellow River deltas; locust plagues (associated with droughts) on the central plain; and two significant earthquakes in central China in 1303 and 1305 that caused over 270,000 fatalities. Last but not least, a series of epidemics swept through the region between 1352 and 1362, the worst of which caused two hundred thousand deaths in the capital area alone in 1358. The Chinese scholar He Fuqiang has calculated that, in the 109 years between 1260 and 1368, the empire suf-

1 The other one was the Sui dynasty (581–618 CE).

2 There were fifty-six earthquakes during the Yuan dynasty, a frequency much higher than under the previous dynasties. Bollinger et al point out that historical earthquakes in Nepal appear remarkably clustered in the thirteenth to fifteenth (1223, 1255, 1344, 1408) and the nineteenth to twenty-first centuries (1833, 1866, 1934, 2015). Laurent Bollinger et al., Slip deficit in central Nepal: omen for a repeat of the 1344 AD earthquake? in: Earth, Planets and Space 68/12 (2016), https://doi.org/10.1186/s40623-016-0389-1.

3 He Fuqiang, "Luan Yuanchu zaihai de chengyin jizhi jiqi shehui zuzhi de biandong论元初灾害的成因机制及其社会组织的变动" [On the Causes of Early Yuan Calamities and Changes of Its Social Mechanism], in: Journal of Xi'an University of Arts and Sciences (Social Sciences Edition), 8:6 (2005), pp. 36–39, here p. 37.

4 Bruce M. S. Campbell, The Great Transition: Climate, Disease and Society in the Late-Medieval World, Cambridge 2016, pp. 21–22.

fered at least two major disasters per year, with five different disasters occurring in four out of every five years. For more than a third of the Yuan era, the empire experienced at least seven distinct natural calamities within the same year, as Table 1 shows:

Table 1: Frequency of natural disasters in China during the Yuan period.

Number of kinds of disasters	Number of years	%
2 kinds of natural disasters	109	100
3 kinds of natural disasters	106	97
4 kinds of natural disasters	100	92
5 kinds of natural disasters	87	80
6 kinds of natural disasters	59	54
7 kinds of natural disasters	36	33
8 kinds of natural disasters	21	19
9 kinds of natural disasters	3	3

The Mongols did not have a tradition of disaster relief before ruling China proper. One could argue that the notion of disaster relief is closely linked to agricultural subsistence crises, but disaster relief as a government policy seemed to have only existed, among all agricultural societies, in traditional China, Korea and Vietnam, i.e. societies of which were heavily influenced by Confucianism. Kublai Khan was willing to adopt this Confucian tradition once he ruled over China in 1271, but it became clear to his successors that the era was a particularly challenging time for any dynasty to apply such policy. 513 natural disasters, of a frequency and intensity unprecedented in Chinese history, strike the empire in less than one hundred years.[5] It was only in the context of these disasters that the overprinting of paper currency, for instance, came to contribute to the fall of the Mongol rule. This point in time and space, to borrow Campbell's comments in regard to pre-industrial England, was truly an era in which "environmental instabilities and hazards ... formed a decisive component of the demographic and economic changes" that resulted in the Yuan dynasty's downfall.[6] This paper examines these factors and explores how climatic disasters on a historic scale devastated the Yuan. The focus is on comparisons between northern and southern China, that is, the empire proper rather than the Eurasian steppe, but the

5 Deng Tuo邓拓, *Zhongguo jiuhuangshi* 中国救荒史 [A History of Natural Disaster Relief in China], Beijing 1998, p. 18.

6 Bruce M. S. Campbell, Nature as historical protagonist: environment and society in pre-industrial England, in: Economic History Review 63/2 (2010), pp. 281–314, here p. 310.

larger context of East and Southeast Asia, especially the climate of nearby northern Vietnam, Korea, and Japan during this period, is considered where appropriate.

1 A Cold Start to the Era: China, Korea and Japan in the Mid-Thirteenth Century

The Yuan came to power in 1280, when northern China, Korea, and Japan were transitioning from a warm to a cold climate. One study of climate changes in China over two millennia, based on 22,562 historical climate records, indicates that there were three dramatic climatic shifts between 137 BCE and 1470 CE, namely around 280 CE (±25 year), 880 CE (±25 years) and 1230~1260 CE (±25 years). Each of them included a sudden change of weather patterns, with the most dramatic one being the last period of the thirteenth century, when the climate became remarkably colder. Between 1260 and 1330, twenty-eight frosts were recorded, five of them in 1260 alone. Up to this point, mulberry trees had grown in the Yellow River delta, but frosts became so frequent and severe between 1260 and 1310 that mulberry growing areas moved from just north of 37ºN to south of 35ºN, or nearly two and a half latitudinal degrees southward.[7] This climatic shift in northern China coincided with the end of the global Medieval Warm Period.

During this period, Korea experienced similarly cold weather. Korean historical records indicate four peaks of cold weather between 918 and 1380 CE: 1271–1280, 1311–1320, 1351–1360, and 1371–1380.[8] Proxy data from Yaku Island, Japan, likewise confirm a drop in mean temperatures during this period.[9] Japanese pollen samples also show the sudden drop in temperature from the mid-thirteenth century on, a change that was dramatic and lasting.[10]

By combining tree-ring data from Mount Qilian in western China with abundant Chinese historical records, Chinese scholars have compiled a chart indicating the changing weather patterns in northwestern China between 900 and 1400 CE.

---

7 Zhang Peiyuan et al., Zhongguo jin 2000 nian lai qihou yanbian de jieduanxing 中国近2000年来气候演变的阶段性 [Stages of Climate Evolution in China in the Last 2000 Years], in: Science in China, Series B-Chemistry, Life Sciences & Earth Sciences (in Chinese) 24/9 (1994), pp. 998–1008, here p. 1004.

8 Lee Jung-ho, Climate Change in East Asia and Agricultural Production Activities in Koryŏ and Japan during the twelfth-thirteenth centuries, in: International Journal of Korean History 12 (2008), pp. 133–156, here p.138. What made northern China, Japan, and Korea different from the medieval warm period in Europe is that there was a cold period in the first half of the twelfth century. The cold weather returned after 1260 and started to get warmer in the later fourteenth century.

9 Bruce L. Batten, Climate Change in Japanese History and Prehistory: A Comparative Overview, in: Occasional Papers in Japanese Studies. Harvard University Edwin O. Reischauer Institute of Japanese Studies, 2009–01 (2009), pp. 1–77, here p. 20.

10 Sakaguchi Yutaka, Climate Change and Human History during the Past 8000 Years, Bulletin of the Department of Geography, University of Tokyo 14 (1982): 1–27.

According to them, there was a warm period between 1000 and 1100 CE, when few snowstorms were recorded, and the area in which farmers were able to cultivate winter wheat was 0.5–1⁰ degree north of the present area. The century between 1100 and 1200 CE, however, saw a big drop in temperature, which was indicated by the year-round snow cover of Mount Qilian and the fact that spring arrived later than usual. That cold century was considerably milder, however, than the period between the late thirteenth and mid-fourteenth centuries; in the late thirteenth century, storms frequently swept across the Mongolian steppe, and four big drops in temperature were recorded by the 1360s.[11] These changes in temperature between 1250 and 1350 closely parallel the Japanese data mentioned above.

The sudden drop in temperature during this period was likely a result of the eruption of the Samalas volcano on Lombok Island, in modern Indonesia, in October 1257.[12] That eruption caused the "year without summer" in 1258 CE. The impacts of the 1257 eruption are evident around the globe: tree-ring records, as well as historical and archaeological sources, show that the northern hemisphere experienced catastrophic floods, crop failures, and unseasonably cold weather the following summer. It was this sudden drop of temperature in northern China that hit the Mongolian rulers long and hard, as the next section discusses.

2 Northern China: Refugees from the Mongolian Steppe

From the late thirteenth century on, snowstorms frequently struck the northernmost regions of the Mongolian steppe, killing livestock and forcing large numbers of people to migrate southwards to the Great Wall area.[13] According to the Yuan Chronicle, by 1308, "the refugees from the north totaled 868,000 households, and everyone lived on disaster relief from the court."[14] Even assuming that the average fourteenth-century

11 Hao Zhixin/ Ge Quansheng/ Zheng Jingyun 郝志新 葛全胜 郑景云, Songyuan shiqi zhongguo xibei dongbu de lengnuan bianhua 宋元时期中国西北东部的冷暖变化 [Changes of Cold and Warm periods in Northwestern China during the Song and Yuan Eras], in: Quaternary Sciences 29/5 (2009), pp. 871–879, here p. 877.

12 Franck Lavigne et al., Source of the Great CE 1257 Mystery Eruption Unveiled, Samalas Volcano, Rinjani Volcanic Complex, Indonesia, in: Proceedings of the National Academy of Sciences of the United States of America 110/41 (2013), pp. 16742–16747, doi: 10.1073/pnas.1307520110.

13 Yuanshi [Official history of the Yuan dynasty] ed. Song Lian, Beijing 1976, here: Chengzong benji 元史·成宗本纪 [Annals of Chengzong Emperor] j.21 "Heavy snow in the areas of twelve postal stations from Chenghai [today's Kobdo in northwestern Mongolia] to the northern border, many horses and cattle died" (稱海至北境十二站大雪，馬牛多死); Lunar Feb 1306: "Heavy snow attacks on the Datong prefecture [today's northern Shanxi and southern Hebei provinces], damaging properties ... many horses and cattle died, people also died". 大同路暴风大雪，坏民庐舍， ... ... 马牛多毙，人亦有死者.

14 Yuanshi, Wuzong benji元史·武宗本纪, j.23 [Yuan History, Chronology of Wuzong Emperor], in 1308: "The refugees from the north now amount to 868,000 households and every one of them relies

Mongolian family was smaller than that of the Han Chinese, at four individuals per household, this still means that some 3.4 million Mongolians had been forced by the cold weather to seek refuge to the south, close to the capital area of Dadu (Beijing). The Yuan court realized that relief on this scale "cannot last long."[15] Between 1307 and 1310, even a poor province like Helin alone distributed over 600,000 *dan* (1 dan = 60 kg) of grain; 40,000 *ding* of paper money; 3,000 fishnets; and 20,000 farm tools to the refugees from the Mongolian steppe.[16]

The Yuan court faced a dilemma. Traditionally, Mongols had been left to cope on their own during natural disasters without any form of official relief. However, the Song dynasty, which the Yuan had overthrown, had continued the practice of governmental relief after natural disasters ("*huang zheng*" 荒政), the idea of which had existed in China for thousands of years. Having adopted Confucian ideals of ruling, Kublai had little choice but to maintain this tradition.[17] Yet unlike previous Chinese dynasties, which had only looked after their own people, the Yuan dynasty was responsible for peoples both within and beyond the Great Wall. This included the Mongols in the north, other Tungusic peoples in the northeast, and Muslims in the northwest. So many requests for famine relief arrived from these regions that they still shock a modern reader, eight hundred years after the collapse of the Yuan dynasty. Kublai's benevolent policy had saddled the Yuan with a financial burden much worse than any that the previous Chinese dynasties had borne. In an age of climate catastrophes, having the largest territory in Chinese history up until that point would now prove highly detrimental to dynastic longevity.

A wave of cold temperatures struck in several surges after the late thirteenth and into the fourteenth century. Between 1314 and 1320, to escape "the super snowstorm of the vast steppe," when "sheep, horses, camels, and all other animals died, people scattered and sold their children into slavery."[18] Large numbers of Mongols moved south to the Great Wall area. The Yuan court repeatedly distributed grain to

---

on the court for their livelihood, this cannot last long. Grant 1.5 million *ding* of paper money in cash, and silk worth 500,000 *ding* of cash to distribute among them, and stop paying them in per diem." 以北來貧民八十六萬八千戶，仰食於官，非久計，給鈔百五十萬錠、幣帛準鈔五十萬錠，命太師月赤察兒、太傅哈剌哈孫分給之，罷其廩給.

15 Ibid.

16 Yuanshi: Wuzong benji (note 14): "The refugees from the north cost 600,000 *dan* of grain, 40,000 *ding* of paper money, 3,000 fishnets, and 200,000 agricultural tools." 贫民迤北而来者，四年间糜粟六十万石，钞四万余锭、鱼网三千、农具二万.

17 Deng Tuo, Zhongguo jiuhuang shi [China's History of Disaster Relief] Beijing 1937; Chen Gang, Natural Disaster Management in Ancient China, in: Chen Gang (ed.) The Politics of Disaster Management in China: Institutions, Interest Groups, and Social Participation, Berlin 2016, pp.11–22; Sun Shaopin, Zhongguo Jiuzai Zhidu Yanjiu [Research on China's Disaster Relief Institutions], Beijing 2004.

18 Yuanshi (note 14), Baizhu zhuan [Biography of Baizhu]: "朔漠大风雪"，"羊马驼畜尽死，人民流散，以子女鬻人为奴".

the displaced and also provided horses and paper money to send the refugees back north, but hungry people kept moving southward. By 1324, when some 290,000 *ding* of paper money – 39% of money printed that year[19] – was spent to send the refugees back, the Great Khan, Kublai's great-grandson Yesün-Temü, had had enough. He ordered that Mongols who migrated south without permission be put to death, while anyone who hid them was to be flogged.[20] But people were hungry, including even the Mongolian court ladies. In 1326, the emperor issued an edict specifically forbidding the "princesses of different [Mongolian] princes from coming to the capital from their banners [Mongolian term for districts] to complain about the hunger."[21] In 1340, when yet another snowstorm hit the northern steppe in lunar March,[22] more horses died; 82,200 *ding* of cash and 1,200 *dan* of grain were sent as relief. An even worse storm struck four months later, in lunar July, when "all the sheep and horses died." This time, some one million *ding* were granted to the soldiers in cash, and another 13,000 *ding* disbursed among the thirteen postal stations in the north.[23]

An enormous amount of grain and paper money was granted as relief for those suffering the consequences of the bad weather between 1301 and 1329. Table 2 shows that over ten million *ding* of paper money and about one and a half million *dan* (or 75,000 tons) of grain, plus thirteen months of rations, were distributed as disaster relief. This was an average of 435,000 *ding* per year, on top of grain and other forms of relief. The revenue of the Yuan court at this time totaled around nine million *ding*.[24] In other words, relief for northern refugees consumed about 5% of revenue per year. Table 2 also reveals that, while the court was willing to pay in both grain and cash during the early period, it became increasingly reluctant to pay in grain after disastrous weather had created a national grain shortage. The Yuan court was thus forced to print more and more paper money; in fact, the amount of paper money distributed to the Mongols increased tenfold between 1319 and 1322 alone. Financial relief for Mongolian refugees thus contributed significantly to the astronomical inflation of the fourteenth century (see below).

19 The money printed that year totalled 750,000 *ding*. See Yuanshi (note 14), "Shihuo" [Economy].
20 "給蒙古流民糧、鈔，遣還所部，敕擅徙者斬，藏匿者杖之," Yuanshi (note 14), j.29.
21 Yuanshi (note 14), Taidingdi," 2.
22 A *lunar* calendar is a calendar based upon the monthly cycles of the Moon's phases (synodic months), in contrast to solar calendars. Lunar March is usually April in the solar calendar.
23 Yuanshi (note 14), Shundi 3.
24 Chen Gaohua/ Shi Weimin, *Zhongguo jingji tongshi yuandai jingji juan*中國經濟通史元代經濟卷 [Comprehensive History of Chinese Economy: Yuan Dynasty], Beijing 2007, vol. 2, p. 509.

Table 2: – Grain and Monetary Relief to the Mongolian Steppe, 1306–1329.[25]

Year	in grain (*dan*)	in cash (*ding*)
1306	2–3 months' grain ration to each district affected; another 44,100 dan of grain to the area affected by the earthquake	3,600
1307	28,000	
1308		2 million
1309	6,000	
1310	600,000 dan over 4 years [1310–1314]	40,000
1313	5,000	
1314	2 months' ration + 7,000	10,873
1315	3,300	7,500
1317	3 months' ration + 10,000	50,000
1319		700,000
1320		1500 per family; 750 per single person
1321		500,000
1322		7.5 million
1323	150,000	2 million
1324	2 months' ration for 5,000 Mongols	290,000
1325	3 months' grain ration for each Mongolian post office	
1326		60,000
1328	85,500	440,000
1329	35,500	50,000

During the cold, dry era when the financial pressure was acute, Mongolian and Muslim refugees were encouraged to break land around the Great Wall area and in the northwestern areas. Around 1321, 4,648 households were farming 42,688 hectares of land in northwestern China, most of which would be gradually abandoned in the two ensuing decades. The ecological balance of vegetation in these semi-arid areas is particularly fragile[26] and the long-term environmental damage caused by this farming in far northern China would have been considerable.

25 Yuanshi (note 14), j.21 to j.30.

26 "Ordered the two thousand refugees under Prince Jin's jurisdiction to open the land in the Chenghai area." 敕晋王部贫民二千居称海屯田". Yuanshi (note 14): Renzong 2, j.26.

3 Floods and Typhoons along the Southeastern China Coast

Agriculture in China is heavily influenced by the monsoon cycles. Cold weather results in weaker monsoons and the rain belt moves southward, causing droughts in northern China and flooding in southern China.[27] The most obvious impact of the cold weather after 1260 in some parts of southern China and northern Vietnam was repeated flooding. For this region, the second half of the thirteenth century was akin to a non-stop La Niña event. During La Niña years, the formation of tropical cyclones, along with the subtropical ridge position, shifts westward across the Pacific Ocean, increasing the threat of storms making landfall in China.[28] Interestingly, frequent typhoons affected the Yangtze delta in 1295, 1296, 1297, and 1301, coinciding with the extreme snowstorms that swept across the Mongolian steppe. In 1297 alone, typhoons in the Wenzhou area cost 6,800 lives.[29]

The frequency of super typhoons rose sharply in the fourteenth century. Like other calamities, typhoons also have their own rhythm. While the historical record for the thirteenth century includes thirty-three typhoons, that number nearly doubled between 1300 and 1399 to sixty. Over 95% of the super typhoons of this period made landfall along the southeastern coast, at the mouth of the Yangtze. Between 1295 and 1390, six super typhoons struck the eastern coast, each causing between six thousand and twenty thousand deaths.[30] The climate was so bad in both northern and southern China after the death of Kublai that his great-grandson, the Yuan Chengzong (Tumür Khan), interpreted it as a divine curse. In 1297, he altered his reign title, which rulers generally retained for decades, to "Dade" ("Great virtue") in the hope of ending the downturn, even though he had had the previous reign title "Yuanzhen" ("Primary allegiance") for only two years.[31]

Both typhoon and drought conditions afflicted a single area of the Yangtze delta in 1301, when a spring drought in Zhenjiang was followed by a strong typhoon in the summer. This was a calamity: the storm devastated arable land along fifty kilometers of the vast coast of the Huai, Zhe, and Fujian provinces; the waves, which reached a

---

27 Guo Qiyun郭 其 蕴, "Dongya xiajifeng de bianhua yu zhongguo jiangshui东亚夏季风的变化与中国降水" [Variations of Summer Monsoon in East Asia and the Rainfall over China], in: 热 带 气 象 (Journal of Tropical Meteorology) 1/1 (1985), pp. 44–51, here p. 48.

28 Wu, M. C./ Chang W. L./ Leung, W. M., Impacts of El Niño–Southern Oscillation Events on Tropical Cyclone Landfalling Activity in the Western North Pacific, in: Journal of Climate 17/6 (2004), pp. 1419–1428.

29 *Xin Yuanshi*: Wuxing新元史·五行志 [A New History of the Yuan: Annals of the Five Elements], ed. KE Shaomin柯劭忞, Shanghai, 1920. 1297 CE: 六月，和州历阳县江水溢，漂庐舍一万八千五百区。七月，彬州耒阳县、衡州酃县大水，溺死三百馀人。九月，温州平阳、瑞安二州水，溺死六千八百馀人.

30 Song Zhenghai 宋正海, Zhongguo dudai ziran zaiyi dongtai fenxi中国古代自然灾异动态分析 [Analyses on the Natural Disasters in Ancient China] Hefei 2002, p. 327.

31 Timothy Brook, Troubled Empire: China in the Yuan and Ming Dynasties, Cambridge /Mass. 2010, p. 72.

height of over thirty (or forty) meters, reached as far as Nanjing, which is 280 kilometers inland.[32] Seventeen thousand died as a direct result of the storm, and over 100,000 starved to death in the resulting famine.[33] Only six days after the typhoon hit the southern coast, on August 5, the northeastern area, where Tungusic peoples lived, flooded; they subsequently received 1,000 *dan* (50 tons) of grain for relief. On August 30, snowstorms hit the twelve post districts from the sea to the north, killing many animals, and causing 11,000 *ding* to be distributed in cash. As if this was not bad enough, the capital area and north-central China suffered extensive flooding, while a locust plague struck the Hebei area.[34]

1301 also marked the beginning of a longer phase of flooding. As Timothy Brook has pointed out:

> Floods recurred on an almost annual basis thereafter. The floods through the years from 1319–1332 were particularly intense. Kublai's descendants were thus fated to rule a flooded realm [...]. When a coastal seawall burst in 1328, the court ordered a group of Tibetan monks to cast 216 statues of the Buddha and pray for divine intervention to no avail: a tidal wave submerged the statue-studded coast the following month.[35]

One typhoon, which hit sometime in 1328, was so disastrous that its damage is recorded in fossilized coral reefs in the South China Sea. Of the six extraordinarily super strong storms in the South China Sea over the last millennium, four occurred between 1000 and 1500, with the other two between 1500 and 1900, giving an average cycle of 160 years.[36] In other words, a storm like the one that hit this area around 1336 (±9 years) only occurred every 160 years.

The financial burden for the Yuan from typhoon damage in this period was many times that which resulted from the northern snowstorms. Southern China was much more densely populated, meaning that disaster relief was more widespread and on a

---

32 Yuanshi (note 14): Wuxing ji: "In July the typhoon caused floods, water levels in the Yangtze river were as high as four to five *zhang* (twelve to fifteen meters) 七月江水暴风大溢，高四五丈，连崇明、通、泰、真州定江等地."

33 Yuanshi (note 14), Zhao Hongwei zhuan元史·赵宏伟传：in 1301 "typhoon and tsunami, houses in the Run, Chang, and Jiangyin prefectures washed away and people are hungry." 大风海溢，润、常、江阴等州庐舍多荡没，民乏食"; Zhengde Gusuzhi 正德姑苏志, j.59: "On the first [day] of lunar July, a tsunami came 100 *li* [6,000 meters] into the Huai [central China], Zhe [southeastern China], and Min [Fujian] provinces, the tide went as high as several tens of *zhang* [at least thirty meters]." 七月初一日淮浙闽海溢百里，潮高数十丈; Qianlong huating xianzhi乾隆华亭县志, j.3: "The sea overflowed and broke the dikes and drowned over 17,000 people." 海大溢，溃塘，漂没人口17000有奇"; Song (note 31), p. 327: "In July 1301, a typhoon washed away houses in Jiangsu province, 80–90% of people died." 江苏7月风漂荡民庐，死者八九.

34 Yuanshi (note 14): Chengzong 3.

35 Brook (note 32), p. 61.

36 Yu Ke-Fu/ Zhao Jian-xin/ Ken D. Collerson, et al., Storm Cycles in the Last Millennium Recorded in Yongshu Reef, Southern South China Sea, in: Palaeogeography Palaeoclimatology Palaeoecology 210/1 (2004), pp. 89–100.

much larger scale. The following is a list of only the worst famines and resulting governmental relief to the Yangtze delta in the early fourteenth century:

- 1300: in lunar September, a drought caused a famine and 229,390 *dan* (11,470 tons) of grain were distributed to 849,060 people.[37]
- 1301: a typhoon led to famine and 87,000 *dan* (4,350 tons) of grain were distributed to 100,000 people.
- 1302: torrential rain fell for fifty days in south central areas, which, from lunar May through November, caused a famine that stretched across fourteen prefectures, including especially the rice granaries of the Yangtze delta.[38] Only five tons of rice were distributed at the subsidized price; the relief efforts of the two preceding years would have limited the court's ability to respond.
- 1307: a typhoon struck the Hangzhou area, and 501,000 *dan* (2,506 tons) of grain were sent as relief.
- 1308: in January, 460,000 households in the Jiangzhe province were suffering a famine and many people died of starvation. Each household was given 0.6 *dan* per month, totaling 13,800 ton per month, plus 300,000 *ding* in paper money. This relief was far from adequate for the Yangtze delta, and 26,000 perished when an epidemic broke out in the spring.[39]

According to the official Yuan chronicle, "big famines coupled with horrible epidemics struck between the reigns of Dade (1297–1307) and Zhida (1308–1312). Almost half of the people in the Yue areas (Yangtze delta) died."[40] Another record gives more vivid details, reporting that, after a famine in 1308, "Jiangzhe province was struck by a terrible epidemic, dead bodies lay upon each other. Fathers sold their sons, and husbands sold their wives, the sound of their crying was so loud that the earth trembled with it."[41]

It is striking to note that these years of calamities along the Yangtze coincided with the superstorm period in the north. This happened repeatedly – in 1301, 1306, 1307, 1308, 1312, 1313, 1319, 1321, 1322, 1323, 1324, 1325, and 1326. Scholars concur that

37 Yuanshi (note 14): Chengzong, j.20.

38 Yuanshi (note 14), j.45: in 1301 in May, Hunger in Fuzhou. In June, hunger was reported in the prefectures of Hangzhou, Jiaxing, Huzhou, Guangde, Ningguo, Raozhou, Taiping, Shaoxing, Qingyuan, and Wuzhou; hunger in the Datong prefecture; July, hunger in the Jiankang prefecture; November, hunger in the Baoding prefecture. 六年五月，福州饥。六月，杭州、嘉兴、湖州、广德、宁国、饶州、太平、绍兴、庆元、婺州等路饥。大同路饥。七月，建康路饥。十一月，保定路饥.

39 1308: "26,000 people in Shaoxing, Qingyuanand Taizhou died of an epidemic." Yuanshi (note 14): Wuxingzhi元史·五行志, j.50.

40 Yuanshi (note 14), *j.177:* "大德、至大间，越大饥，且疫疠，民死者殆半".

41 Yupi lidai tongjian qilan御批历代通鉴辑览 [An imperial Commented on Collections of the Mirror to Aid in Government], j.97: "江浙饥荒之余疫疠大作，死者相枕藉。父卖其子夫鬻其妻，哭声震野，有不忍闻". http://www.3edu.net/gxshibu/22161.html, accessed 2 Dec 2014.

the Yuan currency system was irreparably damaged after the Dade reign (1297–1307).[42] As the foregoing suggests, climate disasters across the country undoubtedly contributed significantly to the inflation and the ultimate collapse of the Yuan dynasty.

The Yangtze delta is the kingdom's granary, which is why the Yuan rebuilt the Great Canal in 1271 to ship grain from the Yangtze delta to food deficient areas in northern China. The revenue from the grain tax during the Yuan dynasty was twelve million *dan* per year, with more than one-third, or 4.5 million *dan*, coming from the Yangtze delta province of Jiangzhe. Another two million *dan* came from the two provinces of Jiangxi and Huguang, both to the south of the Yangtze. These three provinces accounted for 53.5% of the grain revenue.[43] Four-fifths of the country's population lived in these three provinces,[44] which were also the most important area for tea growers, and a crucial source of cotton, silk, and salt. That this region suffered such a series of calamities at about the same period that the superstorms swept over the Mongolian steppe meant that not only was the Yangtze delta unable to function as the granary of the empire, but itself became a recipient of even more disaster relief from the court than the Mongolian refugees. This drained increasingly scarce resources from other districts. For example, after the flood in 1302, 251,000 *dan* of grain were shipped into this area via the Grand Canal instead of out.[45] The extreme famine in 1302 in turn seriously impeded rice production in the Yangtze delta in 1303, when grain shipments from this region fell by 400,000 *dan* (27,200 ton).[46] The natural disasters in these two regions dealt severe blows to the Yuan dynasty in the decades after Kublai Khan's death.

4 Paper Money Printing and Inflation

Scholars have generally attributed the financial demise of the Yuan dynasty to two factors: the extravagant sums that Yuan rulers granted to the Mongolian aristocracy and its army and exorbitant expenditures on warfare. Both arguments have some merit, but it is by no means clear that these were the most significant factors in the destabilization of Yuan power. In fact, such expenses decreased significantly around the beginning of the fourteenth century. In 1307, for example, Emperor Wuzong (Külüg Khan) promised the aristocracy 3.5 million *ding* in cash, but, in the end, only

42 Iwamura Shinobu岩村忍, "元朝的纸币制度及其崩溃" [Yuan Paper Money System and Its Collapse], trans. TOOQEI涛海, in: Menggu xue xinxi蒙古学信息 [Information on Mongol Studies] 2 (1999), pp. 7–9.
43 Yuanshi (note 14), j. 93.
44 Chen Gaohua/ Shi Weimin陈高华/史卫民, General History of Chinese Economy: Yuan Dynasty中国经济通史:元代经济卷, Beijing 2007, vol. 1, p. 19.
45 Zhang (note 2), vol.1: 513: 湖州杭州绍兴等路饥，赈粮25万1千余石.
46 10月以江浙年谷不登减海运粮40万石. Zhang (note 2), vol. 1: 513.

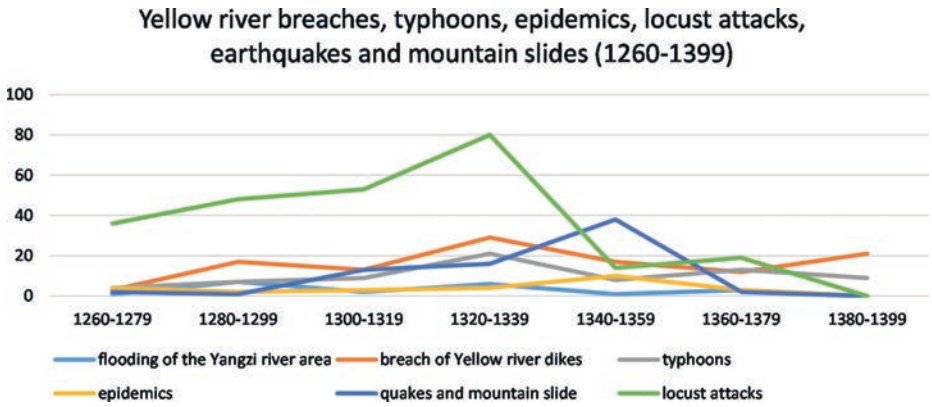

Figure 1: Number of natural disasters in China, 1260–1399.

1.7 million could be procured, because the "exchequer's coffers at both [the summer and winter] capitals [were] empty."[47] By 1311, the amounts awarded were reduced to about one-third of those of 1307, and these were halved by 1317.[48] The Yuan dynasty's military expenditures also shrank after 1295. The only major war in the early fourteenth century was the invasion of Burma in 1301, which cost only 92,000 *ding*.[49] This represented only one-fourth of the cash famine relief distributed in 1308, not counting the 28,784 tons of grain.[50] The established narrative that concentrates on weaknesses in political structure under the Yuan dynasty thus cannot adequately explain its collapse; in fact, the factors these accounts present as most important had in reality been losing significance for half a century prior to its final collapse.

That the Yuan dynasty spent less on both grants to the aristocracy and the military after the death of Kublai is interesting. At first glance it might appear that Kublai's descendants were much less ambitious and talented, but, in the four decades after Kublai's death, the frequent snowstorms in the north, typhoons along the southern coast, and extensive droughts, floods, and strong earthquakes in the central plain, must have seriously undermined the Yuan rulers' capacity to govern. Figure 1 above clearly shows how the number of natural disasters spiked between 1300 and 1350. The locust attacks suggest serious droughts.

---

47 Yuanshi (note 14), [Wuzong] j.22; Chen/ Shi, (note 45), vol. 2, p. 525.

48 Chen/ Shi (note 45), vol. 2, p. 525.

49 Yuanshi (note 14), j.20, "Chengzong3."

50 Yuanshi (note 14), j.22, "Wuzong1" "People of the Jiangzhe are hungry, 535,000 *dan* of rice, 154,000 *ding* of money, 40,000 *jin* of wheat flour were distributed; to the 1.33 million households of refugees, another 536,000 *dan* of rice, 197,000 *ding* of money were added ... "江浙行省管內饑，賑米五十三萬五千石、鈔十五萬四千錠、面四萬斤。又，流民戶百三十三萬九百五十有奇，賑米五十三萬六千石、鈔十九萬七千錠、鹽折直為引五千;濟寧大水入城，詔遣官以鈔五千錠賑之。己巳，真定淫雨，水溢，入自南門，下及槁城，溺死者百七十七人，發米萬七百石賑之.

In at least two cases, the government issued disaster relief in excess of its annual income. In 1307, the Yangtze delta received twenty-four tons of grain and 139,000 *ding* of cash in famine relief, and, when the situation failed to improve, another nineteen tons of grain and 2.3 million in cash were sent the following year. Yuan revenue at this time was around nine million per year,[51] yet in 1308 they spent over ten million in cash and distributed fifty tons of grain, which must have drained their reserves.[52] In 1308, the court printed one million *ding* in cash,[53] but relief to the Yangtze delta alone cost 21% of the currency printed. In 1310, the Yuan issued a new currency based on an exchange ratio of 1:5. The volume of currency produced that year was seven times higher than in any of the three previous years.[54] In 1328, the Yuan issued 343,420 *ding*, but a year later, in 1329, quadrupled the amount to 1.232 million *ding*.[55] The total famine relief distributed in 1329 reached 1.35 million *ding* in cash and 251,700 *dan* (or 15,102 tons) in grain.[56] In 1329, cash and grain for famine relief, plus the tax exemption, would have cost at least 20–30% of total revenue. Under these circumstances, inflation was inevitable: prices in 1306 were thirty times what they had been in 1266, and between 1267 and 1315, salt prices rose sixteen times in *ding*.[57]

5 Breaches of the Yellow River Dikes in Central China

With inflationary pressure rising as a result of the crises in the Yangtze delta, events in central China finally caused the failing system to collapse completely. The Yellow River experienced increasingly frequent flooding from the late thirteenth century into the fourteenth century. As the graph above suggests, the situation peaked between 1320 and 1339. In June 1344, after twenty days of heavy rain, the Yellow River's water level exceeded 6.7 meters and breached the extremely important Baimao (白茅) dike in Shandong province for the second time in two years. Over eighteen districts of central China were flooded. The wild river moved northwards and emptied into the

51 Chen/ Shi (note 45), vol. 2, p. 511.

52 Herbert Franke/, Denis C. Twitchett (eds.), Cambridge History of China, Volume 6: Alien Regimes and Border States, 907–1368, Beijing 1998, p. 585.

53 Yuanshi (note 14), j.93, "Shihuo" [Economy].

54 This currency had to be abandoned in the following year, see Franke/ Twitchett (note 53) pp. 586, 590.

55 Yuanshi (note 14) j.93, "Shihuo" [Economy].

56 Jian Bozan翦伯赞, Zhongwai lishi nianbiao中外历史年表 [Historical Chronology of China and Overseas Countries], Beijing 1979, p. 523.

57 Yang Dehua/ Yang Yongping杨德华,杨永平,Yuanchao de huobi zhengce he tonghuo pengzhang 元朝的货币政策和通货膨胀", in: Yunnan minzu xueyuan xuebao云南民族学院学报 [Journal of Yunnan Institute of Nationalities] 18/5 (2001), pp. 119–120: rice price (per *dan*) 1266: 1 *guan*, 1306: 30 *guan*; salt price (per *yin* = 400 *jin*) 1267: 9 *guan*, 1289: 50 *guan*, 1315: 150 *guan*.

Grand Canal before turning southward into the Huai River, completely changing its course and cutting off the Grand Canal, the north-south artery of the country. Furthermore, the flood threatened the salt fields in Shandong and Hebei provinces.[58] Salt was vitally important to Yuan rule, for salt production generated six-tenths of the Yuan government's total revenue.[59] The Yuan could not afford such drastic changes in economic geography. In 1351, the court initiated a massive project to build a new, 140 kilometer-long channel through central China to force the Yellow River back into its former course. It involved 150,000 laborers plus 20,000 soldiers at a cost of 1.85 million *ding*. The Yuan court printed two million *ding* to pay for the project, but they had nothing with which to back the currency.[60] Central China suffered from natural disasters just as much as, if not more than, the Yangtze delta or the Mongolian steppe in the fourteenth century. The fourteenth century experienced at least thirty-six extraordinarily cold winters, exceeding any previous century on record. The Yellow River delta was more prone to droughts and floods than ever before, and also experienced earthquakes and landslides. The laborers employed in the Yellow River project were very likely in rather poor health, having suffered through the preceding famine years. Moreover, there were only ten months for the massive project to be completed, if the Grand Canal was to be functional for the next season of imperial grain transport. All these factors meant that the populace was tired, money was useless, and the pressure on those in charge made the officers cruel and repressive. The spirit of unrest this kindled flared into open revolt: the Red Turban Rebellion, which originated in this very region, soon spread to the Yangtze delta, and ultimately brought down the Yuan dynasty in 1368.

The Chinese at the time had a ready explanation for the many natural disasters that struck under the Yuan dynasty. According to Confucian philosophy, which was widely accepted among the commoners, human infractions caused anomalies in heaven and earth. The fact that China under Yuan rule suffered such calamities was thus interpreted to mean that the Yuan regime had fallen out of heaven's favor and lost its mandate to rule. The Yuan dynasty's downfall has often been attributed to a flawed political system and to their brutal rule over the Han Chinese. Yet the words of Zhu Yuanzhang, the very man who led the anti-Yuan rebellion and founded the Ming dynasty, suggest that the opposite was the case. Zhu Yuanzhang said: "I examined [the Yuan policies] and it seemed to me that the reason that the Yuan reign ended was precisely because their policies were far too benign."[61] Confucian orthodoxy won

58 Yuanshi (note 14), Zhi 17 b, "Hequ" ["rivers and creeks"].

59 Chen/ Shi (note 45), vol. 2, pp. 422–423.

60 Franke/ Twitchett (note 53), p. 658.

61 "朕观元朝之失天下，失在太宽". Huangming Baoxun皇明宝训[Treasured Lessons of the Imperial Ming], quoted in Yang Yongkang杨永康, The Historical Value of Huangming Baoxun Compiled in the 7th year of Hongwu Period 洪武七年官修《皇明宝训》史料价值初探, in: 史学史研究[Journal of Historiography] 3 (2008), pp. 86–97, here p. 89.

out in the end, however. When his Confucian officers later compiled the 太祖实录 [True Record of Taizu] for this emperor, they quietly reversed Zhu's words, making him appear to suggest that the Yuan had fallen due to their own bad behavior, and thus had lost the mandate of heaven.[62]

6 Conclusion

The impact of natural disasters during the Yuan era has long been discounted, but, as this study has shown that virtually non-stop natural calamities struck the Yuan's ninety-plus-year rule. Coping with so many different sorts of natural catastrophes over such varied climatic regions in their extended empire ultimately paralyzed Yuan institutions, just as the wild weather devastated China's economic cycles of production. As Timothy Brook has astutely observed, "if any single factor defined the complex dynamics of the Yuan and mid-Ming periods, it was the change of weather."[63] It is in this context that one must view the exorbitant inflation and the intra-elite conflicts under the Yuan dynasty. The extraordinary erosion of royal resources exacerbated official corruption and territorial fragmentation. But the Yuan were not alone in facing this dilemma at the time. Victor Lieberman has told a similar story concerning the collapse of charter states in Southeast Asia between 1250 and 1400,[64] a story in which institutional weaknesses and ecological restraints led to a systemic breakdown of social and political structures that ultimately caved under the pressure.

62 中国哲学书电子化计划 Taizu Gaohuangdi shilu 太祖高皇帝实录 *[True record of Taizu]* http://ctext.org/wiki.pl?if=gb&chapter=680790&remap=gb

63 Brook (note 32), back cover page.

64 Victor Lieberman, Charter State Collapse in Southeast Asia, ca. 1250–1400, as a Problem in Regional and World History, in: American Historical Review 116/4 (2011), pp. 937–963.

Paolo Nanni

Facing the Crisis in Medieval Florence: Climate Variability, *Carestie*, and Forms of Adaptation in the First Half of the Fourteenth Century

Abstract: In recent years, medieval climate history has become the subject of interdisciplinary research by scholars and scientists throughout Europe. This research is an opportunity for historians of the Middle Ages to contribute insights gleaned from their work with the written historical record and offer the unique perspective of their own discipline. Moreover, the contribution of Italian historiography can both highlight regional differences compared to the rest of Europe and explain some epistemological aspects of the relationships between environment and history, such as different forms of adaptation in the face of rationing crisis.

The case study of Florence in the first half of the fourteenth century focuses on these historical aspects and presents the opportunity for an interesting and relevant case of political-economic argumentation. Although documented natural events between the thirteenth and fourteenth centuries (excessive rain, cold, flood) confirm the strong climate variability of this era, the famines before the Black Death struck were rationing crises triggered mainly by trade mechanisms. Faced with famine and shortages, the city of Florence managed to curb hunger by adopting rationing policies, creating special magistracies, and using communal purchases to control prices. This study outlines the accounts of these events in the chronicles of Domenico Lenzi and Giovanni Villani before discussing the causes and describing the material remedies that were introduced. These remedies were indicative of a growing civic consciousness, new forms of solidarity, and strengthened political communication.

Keywords: Medieval History, Medieval Economic History, Historical Climatology, Medieval Crisis, Famine, Medieval Climatic Anomaly, Historical Argumentation

1 Introduction

The "crisis of the fourteenth century" is not only a historiographic concept, but a discernible event documented by various material and immaterial social factors. In the context of medieval Italy, the word "crisis" is generally linked to the Black

Paolo Nanni, Assistant Professor, PhD, Dipartimento di Scienze e Tecnologie Agrarie, Alimentari, Ambientali e Forestali (DAGRI), Università di Firenze, P.le delle Cascine 18, 50144 Florence (Italy), paolo.nanni@unifi.it

Open Access. © 2020 Paolo Nanni, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-009

Death, but there are visible signs of crisis before the fateful year of 1348.[1] The Italian peninsula was characterized in the first half of the fourteenth century by population decline, serious famine, and rationing crises. Although there are no general sources that follow Italy's demographic trend in the decades of the first half of the fourteenth century, there is evidence that the continuous population increase of the three preceding centuries not only stopped, but underwent a reversal, especially between the 1330s and 1340s.[2] And even if the famine and food shortage did not trigger a general surge of deaths by starvation in Italy, they nevertheless lowered living standards.[3]

Italian historiography has long addressed the connections between crises, environmental and biological contexts, and climate change,[4] especially in the context of the history of agriculture.[5] The main topics have been around relations between

1 Italia 1350–1450: tra crisi, trasformazione, sviluppo, Atti del Centro Italiano di Studi di Storia e d'Arte, Pistoia 1993.

2 Giuliano Pinto, Dalla tarda antichità alla metà del XVI secolo, in: Lorenzo Del Panta/ Massimo Livi Bacci/ Giuliano Pinto/ Eugenio Sonnino, La popolazione italiana dal Medioevo ad oggi, Roma Bari 1996; Maria Ginatempo/ Lucia Sandri, L'Italia delle città. Il popolamento urbano tra Medioevo e Rinascimento (secoli XIII–XVI), Firenze 1990.

3 Giuliano Pinto, Congiuntura economica, conflitti sociali, rivolte, in: Monique Bourin/ Giovanni Cherubini/ Giuliano Pinto (eds.), Rivolte urbane e rivolte contadine nell'Europa del Trecento. Un confronto, Firenze 2008, pp. 337–349, here p. 343. See also Id., Città e spazi economici nell'Italia comunale, Bologna 1996; Franco Franceschi, Il sogno di una vita più bella. Aspirazioni e obiettivi dei rivoltosi, in: Id., « ... e saremo tutti ricchi». Lavoro, mobilità sociale e conflitti nelle città dell'Italia medievale, Pisa 2012, pp.157–171; Franco Franceschi/ Ilaria Taddei, Le città italiane nel Medioevo XII–XIV secolo, Bologna 2012.

4 Emanuela Guidoboni/ Antonio Navarra/ Enzo Boschi, Nella spirale del clima. Culture e società mediterranee di fronte ai mutamenti climatici, Bologna 2010; Mario Pinna, La storia del clima. Variazioni climatiche e rapporto clima–uomo in età postglaciale (Memorie della Società Geografica Italiana 36), Roma 1984; Id., Il clima nell'alto Medioevo. Conoscenze attuali e prospettive di ricerca, in: L'ambiente vegetale nell'alto Medioevo, Atti del Centro Italiano di Studi sull'Alto Medioevo, Spoleto 1990, vol. 1, pp. 431–451; Paola Sereno, Crisi climatiche e crisi di sussistenza: qualche considerazione sulle interazioni tra ambiente geografico e agricoltura nelle economie d'antico regime, in: Luciano Segre (ed.), Agricoltura, ambiente e sviluppo economico nella storia europea, Milano 1993, pp. 137–155.

5 When the *Rivista di storia dell'agricoltura*, edited by Giovanni Cherubini, decided to fill a historiographic gap by providing a *Storia dell'agricoltura italiana* (2002), from the early cave dwellers up until today, a geographer was given the task of clarifying these specific aspects, with fixed traits and significant variables: Leonardo Rombai, Clima, suolo, ambiente, in: Gaetano Forni, Arnaldo Marcone (eds.), Storia dell'agricoltura italiana, I, L'età antica, 1, Preistoria, Firenze 2002, pp. XVII–LXIV. And the Italian Centre for Studies of History and Art, in Pistoia, when it organized a conference in 2013 on *I Paesaggi agrari d'Europa (secoli XIII–XV)*, dedicated its first paper to this essential issue: Leonardo Rombai, Dall'Atlantico agli Urali: quadro geografico, in: I paesaggi agrari d'Europa (secoli XIII–XV), Atti del Centro Italiano di Studi di Storia e Arte, Pistoia 2015, pp. 33–66.

biomass supplies[6] (especially food supplies in both rural and urban populations[7]), and economic development.[8] Nevertheless, the causes of the fourteenth-century crisis and its outcomes were never inferred exclusively from environmental factors, even if they were taken into consideration.[9] Poor harvests were not enough – at least not in Italy – to set in motion the "infernal cycle" (subsistence crisis) of famine and epidemics described by Le Goff.[10] The impact of calamities (or climatic changes) was different in Italy than in the rest of continental Europe; Italy responded to natural adversities with varied forms of adaptation (especially in central and northern Italy), such as production diversification, market networks, and rationing policies. Considering all the factors typical of northern and central Italian cities and their consolidated market structures,[11] scholars tend to characterize the repeated famines (or shortages) as the "malfunctioning of a system in which the relationship between population and resources had become unbalanced."[12]

Indeed, this link between markets and crises of supply is even reflected in the language, as a careful semantic examination reveals: the words *caristia* or *carestia* in medieval Latin – or *caro*, *carestia* or *carizia* in the vernacular Italian – conveyed

6 Paolo Malanima, Energia e crescita nell'Europa preindustriale, Roma 1996; Id., The Path Towards the Modern Economy. The Role of Energy, in: Bruno Chiarini/ Paolo Malanima (eds.), From Malthus' Stagnation to Sustained Growth. Social, Demographic and Economic Factors, in: Rivista di Politica Economica 4/6 (2010–2011), pp. 71–99.

7 See Giovanni Cherubini, Agricoltura e società rurale nel Medioevo, Firenze 1972; Id., La crisi del Trecento. Bilancio e prospettive di ricerca, in: Studi storici 15 (1974), pp. 660–670; Franco Franceschi, Giovanni Cherubini e la crisi tardo–medievale, in: Duccio Balestracci/ Andrea Barlucchi/ Franco Franceschi/ Paolo Nanni/ Gabriella Piccinni/ Andrea Zorzi (eds.), Uomini, paesaggi, storie. Studi di storia medievale per Giovanni Cherubini, Siena 2012, vol. 2, pp. 1131–1149. On diet: Massimo Montanari, Alimentazione e cultura nel Medioevo, Roma, Bari 1988; Anna Maria Nada Patrone, Alimentazione e malattie nel Medioevo, in: Nicola Tranfaglia/ Massimo Firpo (eds.), La storia, I, Il Medioevo, 1, I quadri generali, Torino 1988, pp. 29–49.

8 Stephan R. Epstein, I caratteri originali. L'economia, in: Francesco Salvestrini (ed.), L'Italia alla fine del Medioevo, I, I caratteri originali nel quadro europeo, Firenze 2006, pp. 381–431; Paolo Malanima, L'economia italiana. Dalla crescita medievale alla crescita contemporanea, Bologna 2012.

9 Franceschi/ Taddei (note 3); Gabriella Piccinni, La proprietà della terra, i percettori dei prodotti e della rendita, in: Giuliano Pinto, Carlo Poni/ Ugo Tucci (eds.), Storia dell'agricoltura italiana, II, Medioevo ed età moderna, Firenze 2002, pp. 145–168; Giuliano Pinto, Le trasformazioni ambientali nella penisola italiana nel basso Medioevo, in: Segre (note 4), pp. 125–135.

10 Jacques Le Goff, La civilisation de l'Occident médiéval, Paris 1964.

11 Luciano Palermo, Scarsità di risorse e storia economica: il dibattito sulla carestia, in: Popolazione e storia 1 (2012), pp. 51–77.

12 In particular, the causes listed are "the relatively small number of producers in relation to the consumers (a direct consequence of the high rate of urbanization), poor land yield, and a potential drop [in yields] because of the overexploitation of soil, growing problems in organization of widespread trade, and a transformation of the land ownership structure and forms of conduct": Franceschi/ Taddei (note 3), p. 26.

a number of meanings in thirteenth- and fourteenth-century sources including "shortage" or "lack" of products but also "rising prices."[13] Famines or shortages were thus not linked (exclusively) to agricultural production levels, even in the views of contemporary Italians, but they represented a "crossover point where the agricultural crisis met the mechanisms of exchange" and therefore a "form of economic crisis."[14]

2 Interdisciplinary Approaches and the "babel" of Languages

However, even if social and cultural factors were of central importance in the fourteenth-century crisis, the transmission and accumulation of historical knowledge always takes place with reference to an audience (e.g., the academic community or society at large), whose scientific approaches, cultural sensibilities, and common opinion change over time.[15] In this sense, the twenty-first-century interest in environmental issues and their societal impacts represents an opportunity which historians should not ignore. Naturally, they remain bound to employ interpretive models that are acceptable within the tradition of their discipline, but they will serve this discipline best by compiling historical data and evidence to answer the questions of their own age.

Moreover, a historical account of the crisis, especially as related to environmental factors, should avail itself of research in variety of related disciplines, even when such an interdisciplinary approach can prove problematic.[16] Research specialization (e.g., geography, archaeology, natural science, historical climatology, and environmental history, economic history, and history *tout court*) requires a fundamental but sometimes difficult communication between scholars who are accustomed to the different methodologies and jargon of their respective fields.

An international group of scholars has analyzed this issue, making a remarkable contribution toward a truly interdisciplinary collaboration. As they observed, the

13 We find the same polysemy in the word *caritas* (*carus*) in classical Latin, as well.

14 Luciano Palermo, Di fronte alla crisi: l'economia e il linguaggio della carestia nelle fonti medievali, in: Pere Benito i Monclús (ed.), Crisis alimentarias en la Edad Media. Modelos, explicaciones y representaciones, Lleida 2012, pp. 47–67.

15 Boris A. Uspenskij, Storia e semiotica, Milano 1988. See: Paolo Nanni, Per un Quadro ambientale e biologico: il periodo caldo Medievale e la variabilità climatica, in: La crescita economica dell'occidente medievale. Un tema storico non ancora esaurito, Atti del Centro Italiano di Studi di Storia e d'Arte, Pistoia 2017, pp. 69–91.

16 Robert I. Rotberg/ Theodore K. Rabb (eds.), Climate and History, Princeton 1981; Tom M.L. Wigley/ Martin J. Ingram/ Graham Farmer (eds.), Climate and History. Studies in Past Climates and Their Impact on Man, Cambridge 1981.

problem is not only how to improve the sharing of data or the need for "translation between different scholarly languages," but "what is further needed, we believe, are research strategies that would be interdisciplinary from the very beginning, where all parties have an equal presence in the staging of the project and determining the research questions."[17] This kind of critical dialogue is fundamental: without a common epistemological foundation that does not mutually exclude humanist and scientific knowledge, today's modern methodological specialization can create nearly insurmountable obstacles to dialogue, even when scholars are ostensibly dealing with the same topics or data.

Scholars, in my opinion, frequently take for granted the preliminary explanation of *what* is being specifically investigated (the object) in the course of subsequently arriving at their own specific methods and contributions. Climatologists and historians use different survey methods, but they differ above all in their focus: historical climatology aims to understand the complexity of climate, not history. Similarly, economic historians are primarily interested in verifying model chains of climatic effects on society and economy[18] or testing economic theories – i.e., criticism of the Malthusian Model,[19] or of more recent works on famines and their causes, based on Amartya Sen's studies.[20]

17 Adam Izdebski et al., Realizing consilience: How better communication between archaeologists, historians and natural scientists can transform the study of past climate change in the Mediterranean, in: Quaternary Science Review (2015), pp. 1–18. See also William J. Meyer/ Carole L. Crumley, Historical Ecology: Using What Works to Cross the Divide, in: Tom Moore/ Xosê–Lois Armada (eds.), Atlantic Europe in the First Millennium BC: Crossing the Divide, Oxford 2011, pp. 109–134.

18 Kates, for example, suggested this chain: primary climate impacts lead to drops in crop and productive livestock yields and increase mortality of people and breeding livestock; secondary climate impacts include increase in biomass prices (food and fodder); tertiary climate impacts encompass the demographic and political effects of price fluctuations (e.g., higher prices). See Christian Pfister, I cambiamenti climatici nella storia dell'Europa. Sviluppi e potenzialità della climatologia storica, in: Luca Bonardi (ed.), Che tempo faceva? Variazioni del clima e conseguenze sul popolamento umano. Fonti, metodologie e prospettive, Milano 2004, pp. 19–59.

19 Bruce M.S. Campbell, Physical Shocks, Biological Hazards, and Human Impacts: the Crisis of the Fourteenth Century Revisited, in: Simonetta Cavaciocchi (ed.), Le interazioni fra economia e ambiente biologico nell'Europa preindustriale secc. XIII–XVIII, Atti dell'Istituto di Storia Economica "F.Datini," Firenze 2010, pp. 13–32. See also: Id., Nature as Historical Protagonist: Environment and Society in Pre-Industrial England, in: Economic History Review 63, 2 (2010), pp. 281–314. The author also refers to: Gregory Clark, The Long March of History: Farm Wages, Population, and Economic Growth, England 1209–1869, in: Economic History Review 60, 1 (2007), pp. 97–135. More recently: Bruce M.S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval World, Cambridge 2016.

20 On the "Entitlement Approach" of Amartya Sen (Nobel Prize in Economic Sciences in 1998), see Luciano Palermo, Il principio dell'Entitlement Approach di Sen e l'analisi delle carestie medievali, in: Manuel Vaquero Piñero/ Maria Luisa Ferrari (eds.), Moia la carestia. Le conseguenze socio–economiche e demografiche della scarsità in età preindustriale, Bologna 2015, pp. 21–36. Amartya Sen

So, faced with these historical issues, what is the historian's contribution? What do historical documents have to say in this regard?

3 Historical Realities and Research Questions

Historical knowledge always needs to remain anchored in the reconstruction of events or case studies, with which historians can test more general overviews and come to a better understanding of the historical forces at play. Therefore, to focus on the connections between environmental history and social history as these are reflected in the fourteenth-century climate variations and the ensuing crisis, I will turn my attention to the problem of food supply in Italian cities, especially in Florence and answer the following research questions:

a) What are the particular characteristics of the study area – in this case, of Tuscany? In other words, an outline of the environmental and historical context is necessary.
b) Which events are relevant and how were they reported? Documentary data, including the chronicles particularly abundant for Italy, not only relate where and when certain events happened, but also sometimes explain why they were thought to have happened and how the men and women of the time perceived the crisis.[21] Indeed, it is quite clear that we cannot reconstruct history without taking into account those who lived it, even, and perhaps especially, when their perceptions differ from ours.[22]
c) Faced with the crisis, how did the population adapt? To be precise, it is not just the remedies adopted that matter, but also how these were carried out in the civil and social context of the time. As we shall see, over time the documents increasingly display a particular kind of political-economic argumentation (the building of civic consciousness), thereby contributing to the historical reconstruction of various forms of adaptation to rationing crises.

considers climatic events an *inter alia* factor in the famine phenomenon: Jean Drèze/ Amartya Sen, Hunger and Public Action, Oxford 1989.

21 Michael Matheus, L'uomo di fronte alle calamità ambientali, in: Michael Matheus/ Gabriella Piccinni/ Giuliano Pinto/ Gian Maria Varanini (eds.), Le calamità ambientali nel tardo Medioevo europeo: realtà, percezioni, reazioni, Atti del Centro Studi sulla Civiltà del tardo Medioevo, Firenze 2010, pp. 1–20.

22 Gherardo Ortalli, "Corso di natura" o "giudizio di Dio." Sensibilità collettiva ed eventi naturali, a proposito del diluvio fiorentino del 1333, in: Id., Lupi genti culture. Uomo e ambiente nel medioevo, Torino 1997, pp. 155–188; Gerrit Jasper Schenk, Dis-astri. Modelli interpretativi delle calamità naturali dal Medioevo al Rinascimento, in Matheus/ Piccinni/ Pinto/ Varanini (note 21), pp. 23–75.

4 Italian Anomalies: Environment, Climate, and Climatic Variability

Among the natural factors that influence agricultural production,[23] climatic variables are among the most important: temperatures[24] (in particular, minimums and maximums) and rainfall[25] (not just total quantity, but also seasonal distribution), as well as general moisture level, wind, and solar radiation.

The climate of the Italian peninsula is characterized by sharp differences due to all of the following: latitudinal range (between the subtropics and middle latitudes); interaction with the warm, shallow Mediterranean Sea, along a coastline that makes up eighty percent of the perimeter (7,500 km out of an overall 9,320 km); the orography of the Alps and Apennines (that separates the two Tyrrhenian and Adriatic sides); and the system of catchment areas (rivers, lakes). In relation to agriculture, the wide-ranging local and regional climates are affected primarily by temperature differences (significant increase toward the southern and central areas) and rainfall (maximum in the Alps and the northern and central Apennines), as well as wind (especially the Apennines and the eastern south and center) and relative moisture (concentrated in the north in summer).[26]

These marked differences in environment, soil, and climate[27] have prevented a general discussion of the history of agricultural structures within Italy and its diverse agrarian economy, land ownership, and farm labor.[28] Environmental features are essential to understanding the formation of the typical agricultural structures[29] and

23 The process of plant growth depends on heat, photosynthesis, and other physiological processes also influenced by heat (soil fertility, water availability, soil thermal level); geographical factors or agrarian systems (latitude, altitude, declivity, water drainage, land management); or changes caused by intense cold, drought, wind, or plant diseases.

24 Of particular importance in the plant world are *cardinal temperatures* (each plant has a temperature at which growth starts, reaches the *optimum*, and stops) and *critical temperatures* (excessive heat or cold that can cause irreparable damage). Combined with drought and wind, high temperatures increase the potential damage, as do sharp drops in temperature (autumn) or rapid thaws (spring). A cold snap in spring is more dangerous than a cold winter.

25 Water availability is critical for crops in all seasons, but it is particularly harmful during periods of tillage, sowing, and harvesting.

26 For the geographical features of the Italian peninsula, see the Atlante Geografico dell'Italia (Istituto Geografico Militare), Firenze 2007; in particular as regards climate factors: Vinicio Pelino (p. 90); Simone Orlandini (p. 93) Marina Baldi (p. 92); Marco Bindi (pp. 94–97)

27 Rombai (note 5).

28 Alfio Cortonesi/ Massimo Montanari (eds.), Medievistica italiana e storia agraria. Risultati e prospettive di una stagione storiografica, Bologna 2001; Alfio Cortonesi/ Gabriella Piccinni, Medioevo nelle campagne, Roma 2006.

29 On the Italian agricultural structures (*cascine, mezzadria, masserie*, i.e., sharecropping farms, large scale farms), see: Paolo Nanni, History of Italian Agriculture and Agricultural Landscapes in the late Middle Ages, in: Rivista di storia dell'agricoltura 2 (2017), pp. 3–24.

of the different types of animal farming and grazing[30] (or transhumance[31]) – from the Middle Ages to the modern age – but fundamental historical factors and political territorial boundaries have also played a significant role in these development.[32]

Despite this complex environmental and climatic context, some data (proxy data and documentary data) is available for fourteenth-century Italy, which confirms the climatic variability documented for the entire continent during this period (Medieval Climatic Anomaly).[33] These data are particularly important in a comparative European framework as they refer to the southern end of the continent (Italian peninsula). As temperature and rainfall are the most important climatic elements for agriculture, a brief summary will suffice.

The information we have about the advance of the main Alpine glaciers – Aletsch, Gorner, Bunte Moor[34] – is confirmed by data collected on Europe's southernmost glacier, the small (and today significantly reduced) Calderone glacier, in Abruzzo's Gran Sasso. Scholars have documented an expansion phase beginning in 1270, which accelerated in the fifteenth century and peaked in the mid–nineteenth century, when a small glacier also appeared near the Majella summit (Abruzzo).[35] Giraudi calculated that the average winter temperature in this period dropped by about four degrees Celsius with respect to the so-called medieval *optimum* or "Medieval Warm Period" (tenth–thirteenth centuries).

The Venetian lagoon's various freezes have been linked to this change in temperature as well, even if, given the phenomenon's complexity, it is more like a record

30 Luisa Chiappa Mauri, Popolazione, popolamento, sistemi colturali, spazi coltivati, aree boschive ed incolte, in: Pinto/ Poni/ Tucci (note 9), pp. 23–57.

31 Antonello Mattone, Pinuccia F. Simbula (eds.), La pastorizia mediterranea. Storia e diritto (secoli XI–XX), Roma 2011; Raffaele Licinio, Uomini e terre nella Puglia medievale. Dagli Svevi agli Aragonesi, Bari 2009; Alfio Cortonesi, L'allevamento, in: Pinto/ Poni/ Tucci (note 9), pp. 83–121; Giovanni Cherubini, Le transumanze del mondo mediterraneo, in: I paesaggi agrari d'Europa (note 5), pp. 247–267.

32 Gabriella Piccinni, Siena, il grano di Maremma e quello dell'ospedale. I provvedimenti economici del 1382, in: Bullettino senese di storia patria 120 (2013), pp. 174–189; Ead. (note 9); Roberta Mucciarelli/ Gabriella Piccinni/ Giuliano Pinto (eds.), La costruzione del dominio cittadino sulle campagne. Italia centro–settentrionale, secoli XII–XIV, Siena 2009.

33 Rudolf Brázdil et al., Historical Climatology in Europe. The State of the Art, in: Climatic Change 70 (2005), pp. 363–430; Ulf Büntgen et al., 2500 years of European climate variability and human susceptibility, in: Science 331 (2011), pp. 578–582; Valérie Masson-Delmotte et al., Information from Paleoclimate Archives, in: Thomas F. Stocker et al. (eds.), Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge New York 2013, pp. 383–464.

34 Emmanuel Le Roy Ladurie, Histoire humaine et comparée du climat, I, Canicules et glaciers XIII^{e}–XVIII^{e} siècles, Paris 2004; Id., Histoire du climat depuis l'an mil, Paris 1967.

35 Carlo Giraudi, La variazioni climatiche in Italia Centrale negli ultimi 10.000 anni, in: Variabilità naturale del clima nell'Olocene ed in tempi storici: un approccio geologico, in: Quaderni della Società Geologica Italiana 1 (2007), pp. 18–24.

of extreme events. Using documentary data, Camuffo[36] reconstructed episodes of repeated freezes in the second decade of the twelfth century (1118, 1122), in the first half of the thirteenth (1234), and again from the fifteenth century (1432, 1443, 1475–76, 1487, 1491, 1514, etc.): these data confirm the recurrence of harsh winters documented also by the freezing of the Po River between the twelfth and fourteenth centuries (1116, 1133, 1216, 1234, 1311, 1355).

Some interesting data about rainfall can be gleaned from the non-perennial lake levels in the central Apennines (Abruzzo and Lazio) – e.g., Lake Mezzano, Lake Fucino (reclaimed in the Roman period and then in the late nineteenth century), and Lake Vico. Fed by significant rainfall and snow melt, the water level of these "ephemeral lakes" rose, especially starting from the fourteenth century, with very extensive lake sediments.[37] Further evidence of this periodization comes also from the geo-archaeological stratigraphy of the Mediterranean coasts, which show desertification (twelfth–fourteenth centuries) and increased alluvial sedimentation (fourteenth–eighteenth centuries).[38]

Beyond this environmental and climatic context,[39] one further factor warrants mention in any account of conditions in medieval Italy: the impact of climate events (especially temperature and rainfall variations) on agriculture and food supply not only changes dramatically from one climatic region or microclimate to another,[40] but also depended upon the various social economic and cultural contexts.[41]

5 Italian Anomalies: Population, Food Supply and Famines

In the context of the present study, urbanization plays an important role, especially in northern and central Italy. At the height of medieval growth, before the crisis, Italy reached not only a high population density with 12.5 million people (about eighteen

36 Dario Camuffo, Clima e uomo. Meteorologia e cultura: dai "fulmini" di Giove alle previsioni via satellite, Milano 1990.

37 Giraudi (note 35).

38 Franco Ortolani/ Silvana Pagliuca, Evidenze geologiche di variazioni climatico–ambientali storiche nell'Area Mediterranea, in: Variabilità naturale del clima (note 35), pp. 13–17.

39 More detailed data may be found in: Jürg Luterbacher et al., A review of 2000 Years of Paleoclimatic Evidence in the Mediterranean, in: Piero Lionello (ed.), The climate of the Mediterranean region, Amsterdam 2012, pp. 87–185; Id. et al, European summer temperatures since Roman times, in: Environmental Research Letters 11 (2016), pp. 1–13

40 Above all, latitude, exposure, soil characteristics, vegetation density, and distance from large bodies of water and ocean currents have an impact on defining agricultural climate zones.

41 Giuliano Pinto, Le città italiane di fronte alle grandi carestie trecentesche: percezione della crisi e politiche annonarie, in: Id., Il lavoro, la povertà, l'assistenza, Roma 2008, pp. 147–161.

percent of the European population excluding Russia within about six percent of the respective area) but also – and more significantly – high rates of urbanization, particularly in the Po Valley between Milan, Venice, and Bologna, and in the Arno Valley around Florence.[42] In the early fourteenth century, it is estimated that twenty to twenty-five percent of the Italian population lived in urban centers, with peaks of thirty percent in Tuscany. The existence of large cities (150,000 inhabitants in Milan; over 100,000 in Venice and Florence) and urban centers in this period led not only to a progressive expansion of cultivated areas (often to the detriment of forests) to increase the food supply[43] but also to an extensive commercial network that encompassed the entire peninsula.[44]

As for grain (especially wheat), one of the most important elements of the food supply, a brief geographic overview of production and consumption can be outlined as follows[45]:

- areas that exported cereals: southern Italy and the islands, the Papal States, and some cities in the Marches and the Po Valley;
- self-sufficient cities able to export in more abundant years: Arezzo, Siena, Romagna, and the main centers in the Po Valley;
- cities that relied on imports in varying degrees: Florence, Lucca, Pisa, Perugia, Bologna, Bergamo, etc.;
- and seaside towns, with limited hinterlands, supplied mainly by the marketplace: Genoa and Venice.

While the cities in the Po Valley – apart from Venice itself (before the conquest of the mainland) and a few other cities like Bergamo, Parma, Modena, and Bologna – generally enjoyed a good balance between cereal production in the countryside and their urban needs, there were major imbalances in central Italy (Tuscany, Umbria, and the Marches), due to the limited existence of plains and low hilly areas. The most problematic cases were Florence, Lucca, Pisa, Perugia, Orvieto, and Ascoli.[46]

Moreover, even if these cities gained control over expanding (small or large) territories or rural areas, their influence as trading centers for goods including foodstuffs went far beyond their boundaries. In the case of Florence, Domenico Lenzi reports

---

42 Pinto (note 2); Ginatempo/ Sandri (note 2); Franceschi/ Taddei (note 3).

43 Giovanni Cherubini, Risorse, paesaggio ed utilizzazione agricola del territorio della Toscana sud–occidentale nei secoli XIV–XV, in: Civiltà ed economia agricola in Toscana nei secc. XIII–XV: problemi della vita delle campagne nel Tardo Medioevo, Atti del Centro Italiano di Studi di Storia e Arte, Pistoia 1981, pp. 91–115; Id., L'approvvigionamento alimentare delle città toscane tra XII e XV secolo, in: Id., Firenze e la Toscana. Scritti vari, Pisa 2013, pp. 39–55.

44 Bruno Dini, La circolazione dei prodotti (secc. VI–XVIII), in: Pinto/ Poni/ Tucci (note 9), pp. 383–448.

45 Giuliano Pinto, L'annona: aspetti e problemi dell'approvvigionamento urbano fra XIII e XV secolo, in: Id., Città e spazi economici nell'Italia comunale, Bologna 1996, pp. 77–96.

46 Pinto (note 41).

that the production of the countryside was sufficient to meet its own needs for a year but could provide the city with grain for only five months.[47] As a result, medieval Florence, a city with about 100,000 inhabitants, relied on the market for seven months of the year, unlike other Tuscan cities that were generally self-sufficient (e.g., Siena or Arezzo). Calculated directly from the market or the gabelles, Lenzi's and Villani's data indicates that about 220–225,000 quintals of wheat were sold annually in the city of Florence.

Narrative sources such as chronicles are abundant for medieval Italy, and these include important news about famines, especially from the thirteenth and fourteenth centuries. Giuliana Albini[48] systematically examined these sources (documentary data) from the region of Emilia, assessing the reliability of the data and the particular historical context of the cities on which the different authors (e.g., Salimbene de Adam) and different works (e.g., the Chronicon Parmense) report. Periods of "general crisis" (climate, famine, epidemics) are recorded in the following years in 1083–1085; 1178–1182; 1227–1228; 1243; 1271–1272; 1275–1278; 1309–1311 (1312 in Lombardy and Italy[49]); 1329–1330; and 1339–1340. The fact that the reports increase beginning in the mid-thirteenth century onwards, does not, as Albini explains, necessarily mean that there had previously been fewer climate events and crises: "The greater frequency of reports relating to bad harvest years and non-catastrophic natural events (such as a rainy season or an unusually dry summer) increased starting from the mid-thirteenth century because of a greater availability of sources and a new focus on these events."[50] In addition, the particular literary genre of these chronicles, a true construction of a city's identity, pays special attention in this period to the relationship between natural events and social and economic life: the "dynamics of price increases"; the "cause-effect relationships between natural phenomena, famines, and epidemics"[51]; the food rationing measures of city governments.

47 Giuliano Pinto, Il Libro del Biadaiolo. Carestie e annona a Firenze dalla metà del '200 al 1348, Firenze 1974, p. 346.

48 Giuliana Albini, Un problema dimenticato: carestie ed epidemie nei secoli XI–XIII. Il caso emiliano, in: Rinaldo Comba/ Irma Naso (eds.), Demografia e società nell'Italia medievale. Secoli IX–XIV, Cuneo 1994, pp. 47–67.

49 "the shortage of all cereals, vegetables, wine, meat and all other victuals was serious throughout Italy, especially in Lombardy" / "grave fu per tuta Italia, masime in Lombardia, carestia d'ogni biave, ligumi, vini, carne e d'ogni altra vitualia": Chronicon Parmense ad anno MXXXVII usque ad annum MCCCXXXVIII, Rerum Italicarum Scriptores, 2nd ed. IX, X, Città di Castello 1902–1904. All the medieval texts quoted in this article are translated into English by the author.

50 Albini (note 48), p. 53.

51 Ibid.

6 Famines in Fourteenth-Century Florence

When, as Le Roy Ladurie wrote, the West found itself ankle-deep in water in the second decade of the fourteenth century at the time of the *Great Famine* (1315–1316), Italy too experienced famine, shortages, and increased mortality. However, the term *Dantean Anomaly*,[52] used to indicate the decade coinciding with the poet's final years, does not correspond exactly to the times of distress in Dante's native land (or the rest of Italy), as we shall see.

The first relevant famines mentioned by the Florentine (and Sienese) chronicles occurred in 1285–1286, when, according to the accounts of Marchionne di Coppo Stefani[53] and Giovanni Villani,[54] there was a drought at the time of sowing; in 1302–1303, excessive rain[55] (also described in the anonymous Sienese chronicle[56]) caused harvests to fail. Other information on later famines appears in various sources for some years in the second decade of the fourteenth century: 1310–1311 in Florence, and 1317 in Romagna, Casentino, and Mugello (Tuscany). Moreover, in the minds of men and women of that time, the *Great Famine* of 1316 in northern Europe must also

52 Neville Brown, History and Climate Change: a Eurocentric Prospective, London, New York 2001.

53 "Due to the great drought of the past year [1285], the cereal harvest was so bad this year [1286] in Florence and throughout Italy [...] that, until this time in Florence, there had never been a comparable famine"/ "Per lo molto secco ch'era stato dell'anno passato [1285] fue sì cattivo ricolto di biade quest'anno [1286] in Firenze ed in tutta Italia (...) che infino a quel dì in Firenze non era mai stata una tale carestia": Marchionne di Coppo Stefani, Cronaca fiorentina, edited by Niccolò Rodolico, Firenze 1903, 2008, p. 62 (rub. 168).

54 "*As in Italy, there was great shortage of victuals*. In the year 1286, especially in the months of April and May, there was a big rise in [the prices of] victuals throughout Italy; in Florence, a 'level' bushel of wheat was worth 18 soldi, in the value of 35 soldi per one gold florin" / "*Come in Italia ebbe grande carestia di vittuaglia*. Nell'anno MCCLXXXVI, spezialmente del mese d'aprile e di maggio, fu grande caro di vittuaglia in tutta Italia, e valse in Firenze lo staio del grano alla misura rasa, soldi XVIII di soldi XXXV il fiorino dell'oro": Giovanni Villani, Nuova cronica, edited by Giuseppe Porta, Varese 2007, vol. I, p. 576 (Lib. VIII, c. 111). It is well known that the value of "soldo" changed during the thirteenth and fourteenth centuries: Richard A. Goldthwaite, The economy of Renaissance Florence, Baltimore 2009. In the quoted excerpt Villani accounts for its value at the given date (1 florin = 35 soldi).

55 "This year [1303] there were very long and heavy rains, so that the grain went completely bad throughout Italy, due to war and the rain this year, a bushel of wheat reached the highest price in Florence that it had even been, or rather a bushel was worth three–fourths of a florin and more" / "In quest'anno [1303] furono grandissime et lunghe piogge per modo che le biade andaro a male per tutto, per modo che per tutta Italia per la guerra e per la pioggia questo anno valse a Firenze lo staio del grano maggior pregio che mai vi fosse valuto, ciò valse tre quarti di fiorino lo staio et più": Stefani (note 53), p. 89 (rub. 237).

56 1303: "It was the highest rise that had ever taken place in three hundred years or more, and the famine was so great that many people died of hunger" / "fue 'l magiore charo che fusse mai già trecento anni o più, ed era sì grande la carestia che molta giente si morì di fame": Cronaca senese dei fatti risguardanti la città e il suo territorio di autore anonimo del secolo XIV, Rerum Italicarum Scriptores, 2nd ed., XV, VI, Bologna 1932, c. 83.

have had great resonance, as recounted in great detail in Villani's chronicle, which also described how grain traders travelled from Sicily and Puglia, lured by the possibility of profiting from the shortage of victuals. However, beginning in the 1320s, a series of more serious problems swept over Italy.

The winter of 1322–1323 was remembered as the coldest in living memory, while the long drought that struck Puglia had consequences on the city markets that were supplied with wheat from those lands. Hunger and famine hit Pisa, Lucca, and Pistoia in particular, and, "due to the famine, the poor fled from the countryside into Florence," where the commune welcomed them, warding off starvation thanks to the many donations (reported by Villani[57] and Stefani[58]). During the following August and September (1323), Florence and the rest of Italy[59] were struck by a general "infirmity of cold," while other famines are documented in Parma, Modena, and Bologna.

The decade ended with a second famine, the severity of which has been compared to the Great Famine.[60] Although specific weather events are not mentioned, the 1328 harvests were so small that the price of wheat rose, increasing still further in the following two years (1329–1330) to the price of one gold florin per bushel.[61] The

57 "*Of a great cold and famine that were in Italy.* In the said year, 1322, in the months of November, December, and January, Italy experienced its most severe winter and more snow than there had ever been for a long time; and in Puglia, the drought was so great that it did not rain for more than eight months, so in the country there was very great hunger and a dearth of all goods; and so, in almost all of Italy, especially in Pisa, Lucca, and Pistoia, great famine and scarcity followed, so that all the poor fled from the countryside to Florence because of the famine; and in Florence itself, prices rose up to two and a half bushels of wheat per gold florin" / "*D'uno grande freddo che fue in Italia e carestia*. Nel detto anno MCCCXXII, del mese di novembre e dicembre e gennaio, fue in Italia la maggiore vernata, e di più nevi che fosse grande tempo passato; e in Puglia fu sì grande secco, che più di mesi VIII stette che non vi piovve, per la qual cosa grandissimo struggimento e carestia di tutti i beni fue nel paese; e così seguì quasi in tutta Italia, spezialmente in Pisa e in Lucca e Pistoia, grandissima fame e carestia, onde tutti i poveri di loro contado fuggirono per la fame a Firenze, e in Firenze medesimo fu caro; le II e mezzo staiora di grano uno fiorino d'oro": Villani (note 54), vol. II, pp. 376–377 (Lib. X, c. 186).

58 "*How there was a great famine throughout almost of Italy and in Florence*. There was a scarcity of all victuals throughout Italy in that year [1322] [...] And all the poor driven from Tuscany were welcomed by the city, and no one died of hunger, such was the great charity of the Florentines" / "*Come fu grande carestia quasi in tutta Italia ed in Firenze*. Fu nell'anno predetto [1322] carestia d'ogni vettovaglia in tutta Italia (...) E tutti i poveri scacciati di Toscana il Comune di Firenze li raccettava, e niuno di fame non morì, tante furono le limosine de' Fiorentini": Stefani (note 53), p. 130 (rub. 352).

59 "*How many suffered from the cold in Florence*. In August and September of said year [1323], there was an almost general infirmity of cold, and many developed a fever and lost their appetite, and many died, old men and women; and that disease was almost throughout Italy, and ceased upon reaching mid–October" / "*Come fu grande quantità in Firenze di infreddati*. Nel detto anno [1323] e del mese d'agosto e di settembre fu una infermità quasi generale di freddo, ed alquanti pigliava loro la febbre, e perdeano l'appetito, ed alquanti ne morieno, cioè vecchi e vecchie, e fu la detta malattia quasi in tutta Italia, e come venne mezzo ottobre restò": Stefani (note 53), p. 133 (rub. 364).

60 Pinto (note 2)

61 The Florentine *staio* (bushel) was 24,36 liters (= 18,3 kg of wheat).

famine was so "harsh" that poor beggars were driven out of Perugia, Siena, Lucca, Pistoia, and other towns in Tuscany. Florence, "with sage advice and good action," welcomed this new flow of people.

The 1330s were marked, first of all, by great downpours in Florence, "almost a revolution of the world in our city" as reported by Villani.[62] His chronicle's twelfth book provides a comprehensive account of the 1333[63] flood, when it seemed that the "floodgates of heaven"[64] had opened, and the Arno inundated the entire city. The following year, the same thing happened again. The third decade ended with the "great mortality" that struck Florence in 1340 from late March until the onset of winter. According to Villani, fifteen thousand people, or one-sixth of its inhabitants, were struck, with deaths in every family. Among those who fell ill, "almost no one escaped" and, after the epidemic, "starvation and rise in prices" followed on top of that from the previous year.[65] The commune intervened with rationing measures once again.

Nevertheless, although the city of Florence was able to cope with repeated and successive famines for about sixty years before the plague, it could do little in the face of the famine that struck in 1346 and 1347. The continuous rain during the autumn sowing (October–November 1345) ruined the crops, and rain and storms the following spring (April–June 1346) damaged the spring sowing, as well. Villani wrote that no one could remember such bad harvests of wheat, other grains, wine, oil, and other foods for more than a hundred years. However, Villani continued, unlike the episodes in 1329 and 1340 when, despite the large price increases, wheat and other grains could be found, the shortages in 1346 were dramatic, with the surrounding countryside producing only a quarter or a sixth of the norm. Moreover, "as always seems to happen" after periods of famine and starvation, "disease and death began in Florence and the countryside, especially among women, children, and poor people." Overall, "it was estimated that more than 4,000 people died in this period."[66] The spring of 1347 was no better: rain and hail ruined the "fruits and grains in many parts of the countryside."[67]

---

62 Villani (note 54), vol. II, p. 798 (Lib. XI, c. 227).

63 The account and the argumentation of the causes of the flood of 1333 in Florence, written by Giovanni Villani, have been studied by many scholars. See: Ortalli (note 22); Laurence Moulinier/ Odile Redon, "Pareano aperte le cataratte del cielo": le ipotesi di Giovanni Villani sull'inondazione del 1333 a Firenze, in: Sofia Boesch Gajano/ Marilena Modica (eds.), Miracoli. Dai segni alla storia, Roma 1999, pp. 137–154; Gerrit Jasper Schenk, " … prima ci fu la cagione de la mala provedenza de' fiorentini … " Disaster and 'Life World': Reactions in the Commune of Florence to the Flood of November 1333, in: The Medieval History Journal 10 (2007), pp. 355–386; Id., L'alluvione del 1333. Discorsi sopra un disastro naturale nella Firenze medievale, in: Medioevo e Rinascimento NS, 18 (2007), pp. 27–54; Francesco Salvestrini, Libera città su fiume regale. Firenze e l'Arno dall'Antichità al Quattrocento, Firenze 2005.

64 Villani (note 54), vol. III, p. 3 (Lib. XII, c. 1).

65 Ibid., vol. III, pp. 225–228 (Lib. XII, c. 114).

66 Ibid., vol. III, p. 485 (Lib. XIII, c. 84).

67 Ibid., vol. III, p. 498 (Lib. XIII, c. 91).

Between November and December of that same year, prices began to rise again, and people were frightened, fearing the return of "past famine."[68] The bad years were aggravated furthermore by the vicissitudes of the market: the simultaneous famine in Venice, that had been caused by the disruption of shipping routes, forced Venetians to turn to Romagna for wheat, thus compromising Florence's provisioning.[69]

7 Reporting the Famine: Events and Provisions of the City

Faced by famine and shortages in the first half of the fourteenth century, the city of Florence managed to curb hunger by adopting rationing policies, special magistracies, and purchases by the commune to control prices.[70] The chronicles report on various aspects of these events; they include a discussion of the causes, and their description of the material remedies shows how civic consciousness and forms of solidarity and political communication developed during this period. Noteworthy examples of the above as pertaining to the 1328–1330 famine are the writings of Domenico Lenzi and Giovanni Villani.

Domenico Lenzi set his hand to his *Specchio Umano* (lit., "Human Mirror," but known as the *Libro del Biadaiolo*) under the effect of the 1328–1330 famine. His detailed description of the people in Florence's Orsanmichele market also conveys everyday scenes, in which farmers and townspeople looking for supplies curse the grain merchants: "These merchants are the ones who are causing the price to increase and you would like to kill all of them and steal from them;"[71] "These thieves want us to starve to death."[72] The government and the rich who stockpile wheat in their homes are also subjected to the wrath of the people: "Behold this ill-guided city that does not let us have wheat! You would like to go into the homes of these robbers that have wheat, set them on fire and burn them inside, since they are keeping us hun-

68 Ibid., vol. III, p. 558 (Lib. XIII, c. 118).

69 "Venice had a great shortage of grain; and because of the great mortality and epidemics of the coastal lands [...] and the struggles of the king of Hungary in Puglia, the Venetians could not have shiploads of wheat from Sicily and Puglia" / "Vinegia avea gran caro di grano; e per la generale mortalità e infermità delle terre marine (...) e per la venuta del re d'Ungheria in Puglia, i Viniziani non potieno avere tratta di grano né di Cicilia né di Puglia": Ibid., p. 558 (Lib. XIII, c. 118). See: Giuliano Pinto, Firenze e la carestia del 1346–1347, in: Id., La Toscana nel tardo Medioevo. Ambiente, economia rurale, società, Firenze 1982, pp. 333–398.

70 Pinto (note 41, 45).

71 "Questi merchatanti sono coloro che amettono il charo e si vorrebbono tutti uccidere e rubagli": Pinto (note 47), p. 293.

72 "Questi ladri ci volliono fare morire di fame": Ibid., p. 296.

gry."[73] Lenzi almost makes those cries his own, organizing his book as a daily report (1320–1335) of grain prices.

The *Libro del Biadaiolo* is thus an extraordinary record of daily prices (Figure 1), probably taken from the notes in his registers or other evidence, for the fifteen years covered by his book. Lenzi's chronicle, however, conveys not only the simple price trend but also data related to the various kinds of wheat and other grains [*biade*] with information from other parts of the peninsula.[74] Furthermore, Lenzi reports on the commune's response to the famine, with the "the Grain Six" [*Sei del Biado*] magistracy and the rationing policies, grain warehouses, various notices, purchases, and sales carried out by the commune. At the same time, Lenzi praises the Florentines who made such generous donations that Florence was able to face the rationing crisis and take in the starving poor that were coming not only from the surrounding countryside but also from such other cities like Siena, Lucca, Pistoia, and Perugia.

> With so great and so cruel a hunger and increase in prices persisting in Florence, certainly, you gentlemen that read, should know that, in other parts of the world, they were not left unaffected by it, but everywhere, according to what some trustworthy souls reported in our city, it [the famine] was perceived as so cruel and severe that the poor resorted to [eating] the roots of different herbs and fruit trees as well as that meat rejected in the past, not only by the mouth but also by the nose. However, Italy, and especially Tuscany, was filled with such troubles and more affected than other parts. But truly I can say that my birthplace, Florence – which has a surrounding countryside able to supply it with its grain for no more than five months [a year], and where the victuals always cost more than in other parts of Italy – succeeded in the said time of hunger in supporting – on its own – half of Tuscany's poor, with Providence and the help of its rich and good citizens and their money. So, it could be said, and truly it was and is so, that from the lands rich in wheat and properties around Tuscany the poor were expelled for fear of running out of supplies and they all flocked with their poverty only to Florence, as a haven of trusted consolation.[75]

---

73 "Ecco città mal guidata, ké non possiamo avere del grano! E si vorrebbe andare alle chase di questi ladroni che n'ànno, e mettervi fuocho e ardeglivi entro perché e' ci tenghono in questa fame": Ibid., p. 302.

74 The famine of 1328–1330 also struck Lombardy, the Marche, Bologna, Rome, Naples, and Puglia.

75 "Durando qui in Firenze tanta e sì chrudele fame e charo, certo, signori che leggete, dovete sapere che l'altri parti del mondo non furono sanza essa, ma in tutte parti, secondo che alchuni di fede degni rapportorono alla nostra cittade, ella si sentì tanto chruda e grava che i poveri ricorrevano a diverse radici d'erbe 'e frutti d'arbori e carni da quinci adietro schifate, non che dalla boccha, ma etiandio dal naso. Tuttavia Ytalia e massimamente Toschana di tale pistilenza si sentì del tutto piena ed intorneata più che altra parte. Ma tanto bene posso io dire che la detta mia patria, Firenze, a la quale nonn è contado che tanto la sostenesse di suo grano quanto è uno spazio di V mesi e ove sempre più vale la vittuallia ch'a nulla parte di Ytalia, nel detto tempo della fame poté essere che bastò a sostenere per sé sola la metà de' poveri Toschi colla provedenza e aiuto de' ricchi buoni cittadini e di loro danari; sì che dire si potea, e vero fu et è, che delle ricche terre di possessioni e di grano intorno a llei, per paura che a lloro non menomasse, cacciati i poveri e tolti loro i conceduti rimedii, solo a Firenze, come a porto di fidata consolatione, colla loro povertà tutti ricorrevano": Pinto (note 47), p. 317.

76 Villani (note 54), vol. II, pp. 670–671 (Lib. XI, c. 119).

Table 1: Grain prices reported during the famine of 1328–1330 in Domenico Lenzi's Libro del Biadaiolo. Data from Pinto (note 47). (1 soldo = 12 denari; for these years 1 florin = 66 soldi).

1327: annual average	13 *soldi*
1328: annual average	17 *soldi*
1329: monthly average (jan)	22 *soldi* and 8 *denari*
1329: monthly average (feb)	24 *soldi* and 6 *denari*
1329: monthly average (mar)	27 *soldi* and 3 *denari*
1329: monthly average (apr)	36 *soldi* and 6 *denari*
1329: monthly average (may)	33 *soldi* and 11 *denari*
1329: monthly average (jun) The first days of June, grain price reached the highest peak of 1 florin (= 66 soldi), as reported also by Villani[76]	45 *soldi* and 6 *denari*
1329: monthly average (jul)	22 *soldi* and 9 *denari*
1329: monthly average (aug)	24 *soldi* and 2 *denari*
1329: monthly average (sep)	29 *soldi* and 10 *denari*
1329: monthly average (oct)	31 *soldi* and 1 *denaro*
1329: monthly average (nov)	32 *soldi*
1329: monthly average (dec)	32 *soldi*
1330: annual average	26 *soldi*
1331: annual average	13 *soldi* and 7 *denari*

Why this emphasis on recording the daily prices of the grain market? Because the availability of supplies on the market was in fact a "human mirror." The abundance was proof of private and public virtues and of the welfare [*bene fare*] of ancient times, while the scarcity was evidence of vices and of the "perverse behavior" of his own period. Moreover, this "human mirror" reflected the lack of pity that Lenzi – with a completely Florentine emphasis – attributed to an haughty [*insuperbita*] Siena, which had expelled its own beggars, in contrast to the "noble city of Florence's true benevolence toward the poor." As a "work of true and fruitful intention" and "effective charity"[77] he mentioned the two grain warehouses [*canove*], which the commune opened in each of the city's districts [*sestieri*] to provide for the poor by distributing eight ounces (about 225 grams) of bread at controlled prices at the commune's expense.

Giovanni Villani's examination of the causes and remedies of the 1328–1330 famine is somewhat more complex. In the absence of specific weather events, the dizzying rise in prices, organized along the same lines as Lenzi, is attributed to market exchange mechanisms, "wheat no longer had a price" and with "rich people" being able to bear

77 Pinto (note 47), p. 323.

the price increases, the consequences fell on poor people.[78] Moreover, as Pinto noted,[79] the loss of access to the port of Pisa as a result of the wars with Castruccio Castracani and Louis the Bavarian forced Florence to fall back on the port of Talamone after an agreement with Siena, making transport complicated. Despite these difficulties, the Republic of Florence faced the crisis by intervening directly with the purchase of wheat. Called personally to be one of the grain [*Biado*] officers, Villani informs us of the sixty thousand gold florins spent to purchase grain for the public warehouses.

8 "Remedy" and "Argument": The Medieval Political-Economic Argumentation

Villani's account of the 1329–1330 famine is remarkable not only in its accuracy and narrative, but as a surprising expression of the historical genre of *scire per causas* (understanding something through its causes) and for its sophisticated political-economic argumentation. Villani gives credit to the historical method inherited from the classical and Christian traditions, delivering a reliable reconstruction of the facts and placing these "in a coherent chronological system and in a causal development, such as to give significance to the fact itself."[80]

Villani structured his text around specific explanations for the famine; he attributed the sudden rise in prices to speculation by the grain merchants, who took advantage of the financial resources of the rich. As a consequence, the poor had even less purchasing power, "and wheat was priceless, as the rich people who needed it were able to pay: as a result, poor people suffered great hardship and affliction."[81] Continuing along this line of causation, Villani dwells on the empirical observations and astrological knowledge of the times to give a full picture of the reported events, pointing out, as he also does in other parts of the *Cronica*,[82] the distinction between necessity and freedom, nature and God's freedom:

78 Villani (note 54), vol. II, pp. 670–671 (Lib. XI, c. 119).

79 Pinto (note 47), p. 91.

80 Marta Sordi, Dalla storiografia classica alla storiografia cristiana, in: Civiltà Classica e Cristiana 3 (1982), pp. 7–29.

81 "e nonn-avea pregio il grano, possendosene avere per danari la gente ricca che n'avea bisogno, onde fu grande stento e dolore a la povera gente": Villani (note 54), vol. II, pp. 670–671 (Lib. XI, c. 119).

82 This distinction between nature and God recurs in other excerpts of the *Cronica*. It's the case, for example, in his account of the flood of 1333 and the debate about the "course of nature" and "God's judgement": Ortalli (note 22); Moulinier/ Redon (note 63); Schenk (note 63); Salvestrini (note 63). In our current vocabulary, the medieval distinction among nature and God's freedom has disappeared, and the term "act of God" normally accounts for natural disasters: Rudi Palmieri, "Act de Dieu" ou "Erreur humaine"? – Analyse argumentative du débat relative à la crise de l'automobile de Détroit (2008), in: ILCEA (online) 15 (2012).

> And note [reader] that when the planet Saturn is in the sign of Cancer and Leo, famine will be in our country of Italy, and especially in our city of Florence, since it seems attributed to that sign. We do not say this will necessarily happen, because God can make worthless what is dear, and dear what is worthless, according to his will, or by the grace of merits or by washing away your sins, but speaking according to nature, Saturn ...[83]

Anyway, what matters in this reconstruction of the causes is that God's freedom calls into play men's freedom, i.e., the peaceful state of the city. Villani thus gives a detailed account of the solutions adopted to face the rationing crisis, an expression of the city's adaptability, through forms of private solidarity (alms) and the commune's initiatives: price ceilings, grain purchases from other markets, and agreements for the transit of goods, even devising a solution for how to ensure that the poorest had daily access to food:

> In those two years, the commune of Florence spent more than sixty thousand gold florins to give sustenance to the people, and all this was not enough; then, finally, the commune's officials decreed that grain not be sold in the market, but bread be made for the commune in all the bakeries, and then every morning, in three or four grain warehouses for every *sestiere* [district of the city], mixed breads [of wheat and other grains] weighing six ounces [about two hundred grams] be sold for the price of four *danari* [12 *danari* = 1 *soldo*][84]

But this measure was not only a "remedy" to solve the problem of the limited food availability or to counter the reduced spending power due to the increased price of wheat, but also an "argument" to maintain peaceful harmony in the city, responding to the needs of the poorest, those who lived hand-to-mouth on low wages:

> This argument supported and satisfied the fury of the people and of the poor: because at least everyone could have bread for subsistence, even those who had 8 or 12 *denari* a day for their livelihood [wages], and did not have the *denari* [money] to buy a bushel.[85]

The use of this pair of nouns – remedy and argument – is highly interesting, but the semantic richness of this hendiadys may be unclear, due to the usage of these two

83 "E nota che sempre che la pianeta di Saturno sarà ne la fine del segno del Cancro e infino al ventre del Leone, carestia fia in questo nostro paese d'Italia, e massimamente nella nostra città di Firenze, però che pare attribuita a parte di quello segno. Questo non diciamo sia però necessitade, che Idio può fare del caro vile e del vile caro secondo sua volontà, o per grazia de' meriti di sante persone o per pulizione de' peccati; ma naturalmente parlando, Saturno ... ": Villani (note 54), vol. II, p. 672 (Lib. XI, c. 119).

84 "E perdévi il Comune di Firenze in quegli due anni più di LXm fiorini d'oro per sostentare il popolo; e tutto questo era niente; se non che infine si provide per gli uficiali del Comune di non vendere grano in piazza, ma di fare pane per lo Comune a tutti i forni, e poi ogni mattina si vendea in tre o quattro canove per sesto di peso d'once VI il pane mischiato per danari IIII l'uno": Ibid., p. 671.

85 "Questo argomento sostenne e contentò la furia del popolo e della povera gente: ch'almeno ciascuno potea avere pane per vivere, e tale avea danari VIII o XII per sua vita il dì, che non potea raunare i danari di comperare lo staio": Ibid.

terms in our ordinary language.[86] In this excerpt Villani remarkably introduces a relevant example of political reasonableness,[87] highlighting how the effectiveness of the remedy (ensuring daily access to food for the poorest) must involve also the efficiency of a reasonable persuasion (i.e., the argument).[88]

The narrative thus becomes the example for building civic consciousness and its state of peace, even in the face of famine.

> We talked this matter over for so long to give an example to our future citizens, so that they will have argument and remedy if our city should find itself in such a dangerous famine/shortage, so that the people might be saved by the pleasure and reverence of God, and the city not suffer any danger of fury or theft.[89]

It is precisely this political-economic argumentation[90] that completes and gives the clearest measure of the ability to adapt in the face of a rationing crisis, be this the result of an actual shortage of production or a crisis in the trade mechanisms.

This care for reasonable persuasion emphasizes the role of argumentation[91] in the political context as an indispensable building block in the construction of the "common good" (*Bene Commune*), even when facing a rationing crisis. Moreover, it is also a relevant case study for the present discussion in the field of the social sciences.[92]

---

86 The Italian language, for example, has lost the original meaning of "argumentum," and the noun "argomento" is commonly used in the sense of "topic" (or confused with "standpoint"). On the contrary, Villani's "argument" expresses the Latin definition of Cicero (Topica 2, 7): "argumentum est ratio quae rei dubiae facit fidem" (argument is the justification that proves the reliability of an otherwise dubious standpoint).

87 See: Eddo Rigotti/ Andrea Rocci/ Sara Greco, The semantic of reasonableness, in: Peter Houtlosser/ Agnes van Rees (eds.), Considering Pragma-Dialectics, London 2006, pp. 257–274.

88 The literal translation of the quoted excerpt is clear: a reasonable conclusion (the fury of the people was satisfied) was inferred from a reasonable argument "*because* at least everyone could have bread" ("*ch*'almeno … ," i.e., "*perché* almeno … ," in the original text).

89 "Avemo fatto sì lungo parlare sopra questa materia per dare esemplo a' nostri cittadini che verranno d'avere argomento e riparo, quando in così pericolosa carestia incorresse la nostra città, acciò che si salvi il popolo al piacere e reverenza di Dio, e la città non incorra in pericolo di furore o rubellazione": Villani (note 54), vol. II, p. 672.

90 It is the very same political-economic argumentation that Ambrogio Lorenzetti immortalized during this same era on the walls of the *Sala dei Nove* (Hall of the Nine) in Siena's town hall. See: Gabriella Piccinni, Siena 1309–1310: il contesto, in: Nora Giordano/ Gabriella Piccinni (eds.), Siena nello specchio del suo Costituto in volgare del 1309–1310, Pisa 2014, pp. 15–36.

91 After the "new rhetoric" (or *linguistic turn*) of the late Fifties (Chaïm Perelman/ Lucie Olbrechts-Tyteca, La nouvelle rhétorique. Traité de l'argumentation, Bruxelles 1958; Stephen E. Toulmin, The Uses of Argument, Cambridge 1958), the theory of argumentation has more recently gained new fundamental contributions: Frans H. van Eemeren/ Rob Grootendorst, A Systematic Theory of Argumentation: The Pragmadialectical Approach, Cambridge 2004; Frans H. van Eemeren, Strategic Maneuvering in Argumentative Discourse. Extending the Pragma-Dialectical Theory of Argumentation, Amsterdam/Philadelphia 2010; Eddo Rigotti/ Sara Greco, Inference in Argumentation. A Topics-Based Approach to Argument Schemes, Cham 2019.

92 Several scholars emphasize also the role of communication and reasonable persuasion in the context of the social sciences (economics, finance, politics): Donald McCloskey/ Arjo Klamer, One Quar-

9 Conclusions

As we said at the beginning, the environmental dimension has taken on new urgency today[93] as scholars seek to advance the environment as a new interpretative and methodological paradigm for reconstructing historical trajectories and thereby discredit other forms of data or argumentative disciplines including history itself.[94] I do not share in this approach, which undermines the most basic historical records. The various elements that I have drawn upon, through major studies of a broad historiography and historical sources, show the signs and causes of a crisis set within a complex web of demographic phenomena (i.e., the ratio of population to food supply) as well as to economics, political, and social contexts. Although natural events are also documented for Italy between the thirteenth and fourteenth centuries, confirming the strong climate variability of those times, the famines before the Black Death were rationing crises triggered primarily by trade mechanisms.

Historians – in dialogue with other disciplines for a complete reconstruction of environmental history – should not only collect and interpret data from their own typical sources (documentary data), but also relate aspects of history (through case studies) that, in a certain sense, transcend the limits of time, making them comprehensible to researchers in other fields and to the general public. The uniqueness of the discipline of history is its ability to locate and reconstruct specific general historical contexts (politics, economics, society, and culture), acts of genius, choices, and plans by individuals and communities, which are never necessarily derived from determinate factors: like Villani's "remedy and argument," a case of a political-economic argumentation can be of great interest and relevance.

I believe that thus the voice of history can make its own original contribution.

---

ter of GDP is Persuasion, in: The American Economic Review 85, 2 (1995), pp. 191–195; Sandy E. Green, *A Rhetorical Theory of Diffusion*, in: Academy of Management Review 29, 4 (2004), pp. 653–669; Rudi Palmieri, *Corporate argumentation in takeover bids*, Amsterdam/Philadelphia 2014.

93 Paul Acot, Histoire du climat. Du Big Bang aux catastrophe climatiques, Paris 2009; Wolfgang Behringer, Kulturgeschichte des Klimas. Von der Eiszeit zur globalen Erwärmung, München 2010.

94 In this context, the success of Jared Diamond's book attributing differences between peoples from various continents to "environmental differences" is emblematic (Jared Diamond, Guns, Germs, and Steel. The Fates of Human Societies, New York 1997): with confidence in history waning, environmental history or geo-history is offered as the new paradigm of history. On closer inspection, it is a particular form of manipulation that takes advantage of the confidence placed in so-called "scientific" knowledge by involving "experts" from the field of "science" in areas that are foreign to them: see Sara Greco Morasso/ Carlo Morasso, Argumentation from expert opinion in science journalism: the case of Eureka's Fight Club, in: Steve Oswald/ Thierry Herrman (eds.), Rhétorique et Cognition, Bern 2014, pp. 185–212.

Johannes Preiser-Kapeller, Ekaterini Mitsiou

The Little Ice Age and Byzantium within the Eastern Mediterranean, ca. 1200–1350: An Essay on Old Debates and New Scenarios

Abstract: This paper discusses written historical documentation and paleo-environmental evidence in order to explore connections between climatic and socio-economic change. It focuses thereby on the Byzantine Empire and the eastern Mediterranean more generally in the period between the collapse and "restoration" of Byzantine rule in Constantinople (1204–1261) and the beginning of Ottoman expansion in the Balkans in 1352, which roughly coincided with the outbreak of the first wave of the "Black Death" in 1347. The paper entails juxtaposing various older scenarios of "fatal" social and political developments in Byzantine history with new studies based on proxy data from regions across the Balkans and Asia Minor and comparing these events with developments in other polities of the region during the transformation from the "Medieval Climate Anomaly" to the "Little Ice Age."

Keywords: Byzantine Empire, Mediterranean Studies, Climate History, Little Ice Age, Medieval Balkans, Ottoman History, Environmental History, Plague

1 Introduction – Old Debates

Contemporary scholarship still often considers late Byzantium a "pseudo-empire" that was more or less "programmed" for destruction after the Fourth Crusade's conquest of Constantinople in 1204 (or even earlier) and interprets the development of the subsequent 250 years from the perspective of their endpoint, the Ottoman conquest of 1453.[1] In this narrative, the demise of Byzantium is hardly a unique case of "decline" and collapse but rather part of the general "crisis of the late Middle Ages" and the

1 Peter Schreiner, Schein und Sein. Überlegungen zu den Ursachen des Untergangs des byzantinischen Reiches, in: Historische Zeitschrift 266 (1998), pp. 625–647. For a more detailed discussion of the historiography and the period in general, see also: Johannes Preiser-Kapeller, Complex historical dynamics of crisis: the case of Byzantium, in: Sigrid Jalkotzy-Deger/ Arnold Suppan (eds.), Krise und Transformation, Vienna 2012, pp. 69–127.

Mag. Dr. Johannes Preiser-Kapeller, **Dr. Ekaterini Mitsiou**, Institut für Mittelalterforschung/Abteilung Byzanzforschung, Österreichische Akademie der Wissenschaften, Hollandstraße 11-13/4, 1020 Wien (Österreich), Johannes.Preiser-Kapeller@oeaw.ac.at, Ekaterini.Mitsiou@assoc.oeaw.ac.at

Open Access. © 2020 Johannes Preiser-Kapeller, Ekaterini Mitsiou, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-010

calamities and widespread socio-economic and political instability that swept across Afro-Eurasia during this time.[2]

This common scenario has, however, undergone significant revision over the course of the last century. Historians began by re-assessing the late medieval period from the perspective of cultural history,[3] and the emerging disciplines of economic and social history went on to establish an empirical foundation for the concept of a late medieval crisis in various countries of Western Europe.[4] This model was closely connected to the hypothesis that the Black Death had counteracted growing demographic pressure and resulted in better living conditions for the smaller population which remained. According to this theory, this long-term beneficial development had permitted the "Rise of the West" in the early modern age as Europe outpaced other regions of the globe. The well-documented English case seemed especially to support such a "Malthusian" model; John Hatcher and Mark Bailey concluded: "The case for a demographic downturn along Malthusian lines around c. 1300 has been argued so many times that is has become something of an orthodoxy."[5] Angeliki Laiou has likewise proposed a growth period in Byzantium starting in the tenth century which was followed by a "Malthusian impasse" in the late thirteenth and early fourteenth centuries. Laiou analyzed tax registers *(praktika)* for a number of Macedonian villages that were in the possession of monasteries of Mount Athos, and her study, published in

2 Ulf Dirlmeier/ Gerhard Fouquet/ Bernd Fuhrmann: Europa im Spätmittelalter 1215–1378 (Oldenbourg Grundriss der Geschichte 8), 2nd ed., Munich 2009, pp. 3–8, 41–52, 183–193. Victor Lieberman, Strange Parallels. Southeast Asia in Global Context, c. 800–1830. Vol. 2: Mainland Mirrors: Europe, Japan, China, South Asia, and the Islands, Cambridge 2009, pp. 77–84; Wolfgang Behringer, Kulturgeschichte des Klimas. Von der Eiszeit bis zur globalen Erwärmung, Munich 2007, pp. 119–162; John Watts, The Making of Polities. Europe, 1300–1500 (Cambridge Medieval Textbooks), Cambridge 2009, pp. 13–19. Behringer also examines this "grand narrative" of the late medieval period from a critical perspective.

3 See for instance Johan Huizinga's classic "The Autumn of the Middle Ages," first published in 1919. See also, František Graus, Pest, Geißler, Judenmorde. Das 14. Jahrhundert als Krisenzeit, 2nd ed., Göttingen 1988.

4 Michael M. Postan, Revisions in Economic History, in: Economic History Review 9 (1938/1939), pp. 160–167; Wilhelm Abel, Agrarkrisen und Agrarkonjunktur in Mitteleuropa vom 13. bis zum 19. Jh., Berlin 1935; Marc Bloch, Les caractères originaux de l´histoire rurale française, Paris 1931. Cf. also now John Drendel (ed.), Crisis in the Later Middle Ages. Beyond the Postan-Duby Paradigm (The Medieval Countryside 13), Turnhout 2015.

5 John Hatcher/ Mark Bailey, Modelling the Middle Ages. The History and Theory of England's Economic Development, Oxford 2001, pp. 30–52. Cf. also Bruce M. S. Campbell, English Seignorial Agriculture 1250–1450 (Cambridge Studies in Historical Geography 31), Cambridge 2000, pp. 1–25; Dirlmeier/ Fouquet/ Fuhrmann (note 2), pp. 16–21, 158–168; Watts (note 2), pp. 13–19; Daniel R. Curtis, Coping with Crisis. The resilience and vulnerability of pre-industrial settlements, Farnham, Burlington 2014, pp. 2–4.

2007, found that the rural population was declining in the first half of the fourteenth century, even before the plague struck, and that the economic situation of peasant households was deteriorating, as well (see also Table 2).[6]

However, Laiou herself had been more cautious regarding a possible "Malthusian" mechanism in an earlier survey of the late Byzantine agricultural economy in 2002, in which she highlighted the relevance of social and economic factors – e.g., the relationship between landowners and peasants – that had affected the material situation of the majority of the population beyond demographic pressures per se.[7] The generally accepted explanation of the calamities which befell the Byzantine Empire in its last centuries – or even beginning in the eleventh century – focuses on the growth of the economic and political power of the "aristocratic" great families at the expense of the free peasantry, which in this interpretation had provided the financial and military backbone of the empire since the seventh century and which the emperors had tried in the tenth century to protect with legislative measures to no avail. Georg Ostrogorsky (1902–1976) wrote accordingly about the "feudalization" of Byzantium,[8] and Peter Schreiner asserted in 1998 that this "gain of private interests at the expense of the state" was "the seed of decay" which finally led to the collapse of Byzantium.[9] Recent research, however, has qualified these views with regard to the impact of large-scale ownership on economic expansion from the tenth to thirteenth century, which was especially strong in the European provinces of Byzantium. In her 2002 study, Laiou states: "The large estate, once thought to signal and promote the collapse of Byzantium and its agrarian base, is now seen as a factor in economic

6 Angeliki Laiou/ Cécile Morrisson, The Byzantine Economy (Cambridge Medieval Textbooks), Cambridge 2007, pp. 169–170; Angeliki Laiou, The Palaiologoi and the World around them (1261–1400), in: Jonathan Shepard (ed.), The Cambridge History of the Byzantine Empire, c. 500–1492, Cambridge 2008, pp. 803–833, here pp. 817–818. For the data from the tax registers cf. also Angeliki E. Laiou, Peasant Society in the Late Byzantine Empire. A Social and Demographical Study, Princeton/ N.J. 1977; Jacques Lefort, Population et peuplement en Macédoine orientale, IXe-XVe siecle, in: Catherine Abadie-Reynal et al. (eds.), Hommes et Richesses dans l'Empire Byzantin, vol. 2, Paris 1991, pp. 63–89. For further literature on the discussion of Malthus and Byzantium see Preiser-Kapeller (note 1), pp. 78–81.

7 Angeliki Laiou, The Agrarian Economy, Thirteenth-Fifteenth Centuries, in: Angeliki Laiou (ed.): The Economic History of Byzantium. From the Seventh through the Fifteenth Century, Washington / D. C. 2002, pp. 311–375, here pp. 316–317. For a new evaluation of the evidence, see also Kostis Smyrlis, Byzantium, in: Harilaos Kitsikopoulos (ed.), Agrarian Change and Crisis in Europe, 1200–1500, New York 2012, pp. 128–164.

8 Georg Ostrogorsky, Geschichte des byzantinischen Staates, Munich 1963 (English version Oxford 1968, there pp. 316–375); Georg Ostrogorsky, Pour l'histoire de la féodalité byzantine (Corpus Bruxellense Historiae Byzantinae, Subsidia I), Brussels 1954. On this debate see also Preiser-Kapeller (note 1), esp. pp. 72–77 and 91–93. A systematic and detailed survey of relevant documents is now provided by Mark C. Bartusis, Land and Privilege in Byzantium. The Institution of Pronoia, Cambridge 2012; cf. also the review of this monograph by Ekaterini Mitsiou, in: Medioevo Greco 14 (2014), pp. 37–43.

9 Schreiner (note 1), pp. 625–647.

expansion."[10] Alan Harvey in 2006 considered the advance of the great aristocratic estates essential for economic and demographic growth in the tenth and eleventh centuries, suggesting that the emperors' legislative efforts to limit this expansion were "misconceived" and impeded the "very process that was enriching Byzantine society as a whole." It was only these larger-scale economic entities, according to Harvey, that could afford the necessary investment for an intensification of land use.[11] In 2008, however, Mark Whittow disagreed: "We should perhaps be thinking of a world where landowning aristocrats hijacked the fruits of pioneering peasant enterprise. [...] Did the great estates necessarily promote local and regional economic enterprise, or did they dampen such activity in favor of self-sufficiency and the provision of goods in kind to feed their dependents in the capital? [...] An economy, in other words, shifting, like that of later medieval eastern Europe, to become one of great estates producing for a profitable export market, but in so doing fundamentally damaging its social base."[12]

Whittow draws up a scenario discussed at length in the 1970s and 1980s in the so-called "Brenner Debate," sparked by Robert Brenner's (Marxist) criticism of the "Neo-Malthusian Orthodoxy" (as Guy Bois has called it) represented in the work of Michael M. Postan and others. Brenner challenged this demographic determinism and emphasized the (in turn, for him universal) role of "social-property relationships and balances of class forces" in the socio-economic trajectories in different European polities at the dawn of the early modern period.[13] Although historians never generally accepted Brenner's mono-causal interpretation, the important influence of socio-economic factors and the institutional framework – such as the relationship between an aristocratic elite and the majority of the population – on demographic trends seems evident.[14] In 2005, Stuart J. Borsch extended this discussion to Mamluk Egypt, which he contrasted with late medieval England. While both polities suffered a comparable loss of population in the mid-fourteenth century due to the plague, the material conditions of the population in England improved after this period of general contraction, and population numbers and agrarian productivity began to increase in the fifteenth century. Not so in Egypt, where population, agrarian output,

10 Laiou (note 7), p. 1150.

11 Alan Harvey, The Byzantine Economy in an International Context, in: Historisch Tijdschrift Groniek 39/171 (2006), pp. 163–174, here p. 170. See also his monograph: Alan Harvey, Economic Expansion in the Byzantine Empire, 900–1200, Cambridge 1989.

12 Mark Whittow, The Middle Byzantine Economy (600–1204), in: Jonathan Shepard (ed.), The Cambridge History of the Byzantine Empire, c. 500–1492, Cambridge 2008, pp. 465–492, esp. pp. 487–491.

13 Cf. Robert Brenner, Agrarian Class Structure and Economic Development in Pre-Industrial Europe, in: Trevor Henry Aston/ C. H. E. Philpin (eds.), The Brenner Debate. Agrarian Class Structure and Economic Development in Pre-Industrial Europe, Cambridge 1985, pp. 10–63, esp. p. 23; Guy Bois, Against the Neo-Malthusian Orthodoxy, in: ibid., pp. 107–118, and the other papers reprinted in this volume. Cf. also Hatcher/ Bailey (note 5), pp. 52–65.

14 Cf. also Curtis (note 5), pp. 4–7; Verena Winiwarter/ Martin Knoll, Umweltgeschichte. Eine Einführung, Cologne, Weimar, Vienna 2007, pp. 73–78.

and living conditions declined further in the wake of the Black Death. Borsch identifies the main cause for this divergence in the fact that English landholders failed in their efforts to collectively confront a scarce rural labor market and "to intensify the mechanisms of coercive surplus-extraction," and therefore had to accept lower rents for their land, higher wages for labor, etc. As a result, "economic opportunities for those below the top of the social pyramid expanded." The Mamluks, on the other hand, were able to "collectively force" a consistently high level of surplus-extraction onto the reduced agrarian population after the Black Death, but this led over time to further deterioration in material conditions and a decline in agrarian yields, which ultimately resulted in long-term demographic depression.[15]

If we accept Whittow's argument, Byzantium's "wrong turn" in its socio-economic development came already in the eleventh or twelfth century, when it began marching "backwards" – i.e., away from the path towards modern economic growth later followed by England and other western European societies.[16] Yet, more recent detailed studies on various regions and settlements within Europe have shattered various assumptions on which both models (the "Malthusian" and the "Brenner") relied: one found neither a ubiquitous "Malthusian impasse" nor a universal "golden age of low and middle incomes" after the Black Death.[17] John Hatcher and Mark Bailey conclude: "The foundations on which each grand model is built, and the methods by which it proceeds, are essentially far too crude. At best they might be applicable to very simple systems, but modern research has confirmed that the medieval economy was relatively complex and that it operated within a sophisticated environment." In the face of the high diversity of crisis- (and non-crisis-) phenomena within the politically cracked landscape of fourteenth-century Western Europe, some scholars (such as Peter Schuster) even totally negate the existence of a late medieval crisis and consider it a "fantasy of the twentieth century."[18]

As a result of these debates within the scholarship, there is no monolithic established view on the events of the fourteenth century remaining, which makes the contribution of new data and perspectives from environmental studies that much more valuable in its potential to help mend this fragmentation. As Bruce Campbell high-

15 Stuart James Borsch, The Black Death in Egypt and England. A Comparative Study, Austin 2005, pp. 24–66 and pp. 113–117. Borsch's analysis borrows heavily from the model Guy Bois has developed for Normandy, see Guy Bois, Crise du féodalisme, Paris 1976, and Michael North, Europa expandiert 1250–1500 (Handbuch der Geschichte Europas 4), Stuttgart 2007, pp. 365–366 (for a useful summary of Bois' model).

16 Daniel Chirot (ed.), The Origins of Backwardness in Eastern Europe. Economic and Politics from the Middle Ages until the Early Twentieth Century, Berkeley, Los Angeles, Oxford 1989.

17 For an overview, see Peter Schuster, Die Krise des Spätmittelalters. Zur Evidenz eines sozial- und wirtschaftsgeschichtlichen Paradigmas in der Geschichtsschreibung des 20. Jahrhunderts, in: Historische Zeitschrift 269 (1999), pp. 19–55, and Drendel (note 4).

18 Hatcher/ Bailey (note 5), p. 209; Schuster (note 17). Cf. Dirlmeier/ Fouquet/ Fuhrmann (note 2), for an overview on these debates.

lighted in his recent magisterial study on the "Great Transition,"[19] empirical evidence suggests that the entire "old world" from eastern Asia to the Viking colonies on Greenland was affected by dramatic changes on a global scale when the so-called "Medieval Climate Anomaly" of circa 850–1300 came to an end with an accumulation of extreme weather events and the Black Death, which spread via the commercial routes that had been established during the preceding *Pax Mongolica* from central Asia into the Mediterranean and the rest of Europe as well as into China.[20] The epidemic's local and regional impacts and consequences depended on the circumstances of these individual societies and their vulnerability, and the outcomes included varying degrees of societal collapse but also the emergence of powerful new polities. By providing a global framework for this period, the discipline of environmental studies allows scholars to analyze similar crisis phenomena and how these influenced the development of societies with different (or similar) traditions, religions, institutions, geographies, or ecologies. Byzantium is just one potentially illuminating example for such a study.[21]

2 New Data and New Scenarios

Paleoclimatic research incorporates both the methods and scholarship of traditional history and evidence gathered in the natural sciences; the Swiss pioneer of climate history Christian Pfister distinguished the "archives of society" – i.e., primarily written sources – and the "archives of nature" – i.e., the evidence of past climatic conditions found in tree rings, lake sediments, or dripstones (speleothems).[22] These "proxies" allow for paleoclimatic reconstructions of varying durations and chronologies stretching over millennia to individual years (or even shorter intervals) and spatial resolutions from the global down to the local level. An extremely important

19 Bruce M. S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval Worlds, Cambridge 2016.

20 Emmanuel Le Roy Ladurie spoke in 1973 already of L'Unification Microbienne du Monde (XIV-XVII Siècles), in: Schweizerische Zeitschrift für Geschichte 23 (1973), pp. 627–696. Cf. also Janet L. Abu-Lughod, Before European Hegemony. The World System A.D. 1250–1350, New York, Oxford 1989.

21 See also Jared Diamond/ James A. Robinson, Natural Experiments of History, Cambridge / Mass., London 2011.

22 Christian Pfister, Klimageschichte der Schweiz 1525–1860. Das Klima der Schweiz von 1525–1860 und seine Bedeutung in der Geschichte von Bevölkerung und Landwirtschaft, 2 vol., Bern, Stuttgart 1985; Franz Mauelshagen, Klimageschichte der Neuzeit (Geschichte Kompakt), Darmstadt 2010; Jürg Luterbacher et al., A Review of 2000 Years of Paleoclimatic Evidence in the Mediterranean, in: P. Lionello (ed.), The Climate of the Mediterranean region: from the past to the future, Amsterdam 2012, pp. 87–185 (with sections on various natural scientific data). For further bibliography cf. also Johannes Preiser-Kapeller, A Collapse of the Eastern Mediterranean? New results and theories on the interplay between climate and societies in Byzantium and the Near East, ca. 1000–1200 AD, in: Jahrbuch der Österreichischen Byzantinistik 65 (2015), pp. 195–242.

collection in this "natural archive" is lake sedimentation, which can be resolved in annual layers. Lake sediments, for example, often include pollen from plants from areas even further afield. Palynologists are then able to identify these different species and their relative share of the vegetation of the surrounding area and subsequently to reconstruct climatic changes and human interventions (via "anthropogenic indicators") in the landscape.[23] In addition to pollen, the composition of sediments can offer other important information on past climatic conditions via, for instance, oxygen isotope analysis.[24] The "social archives" encompass mainly written sources, which sometimes include direct meteorological observations of anomalies such as extreme winters or flood events, but also indirect data about the beginning of plant flowering, for instance, which allow for conclusions on weather conditions.[25]

By drawing on both the archive of nature and of society, historical climate research is increasingly able, both globally and regionally, to reconstruct climate history and assess its impacts on human societies over centuries and millennia. For Byzantine studies, groundbreaking in this regard is the work of Ioannis G. Telelis, who not only provided the first systematic survey of meteorological information on Greek and other written sources for the medieval eastern Mediterranean in two massive volumes published in 2004, but has also outlined a methodological basis for combining the archives of society and of nature (see also Table 1) in several articles.[26] Since then, an

23 On methods, potentials, and problems, especially for the interpretation and dating of pollen sequences from sites in Byzantine Anatolia and the Near East, see Adam Izdebski, A Rural Economy in Transition. Asia Minor from Late Antiquity into the Early Middle Ages (Journal of Juristic Papyrology, Supplement vol. 18), Warsaw 2013, pp. 109–132. See also Warren J. Eastwood, Palaeoecology and eastern Mediterranean Landscapes: Theoretical and practical approaches, in: John F. Haldon (ed.), General Issues in the Study of Medieval Logistics: Sources, Problems and Methodologies, Leiden 2006, pp. 119–158.

24 C. Neil Roberts/ Giovanni Zanchetta/ Matthew D. Jones, Oxygen isotopes as tracers of Mediterranean climate variability: an introduction, in: Global and Planetary Change 71 (2010), pp. 135–140. For a practical example, see Jonathan R. Dean et al., Palaeo-seasonality of the last two millennia reconstructed from the oxygen isotope composition of carbonates and diatom silica from Nar Gölü, central Turkey, in: Quaternary Science Reviews 66 (2013), pp. 35–44. For the pitfalls connected with a neglect of the uncertainties regarding the temporal resolution and spans of dating of such sediments and data for their historical interpretation, cf. John F. Haldon et al., The Climate and Environment of Byzantine Anatolia: Integrating Science, History, and Archaeology, in: Journal of Interdisciplinary History 45/2 (2014), pp. 113–161, esp. pp. 120–121.

25 On the use of historical documents for climate reconstructions, see Raymond S. Bradley, Paleoclimatology. Reconstructing Climates of the Quaternary, Amsterdam, Waltham, San Diego 2014, pp. 517–551. Cf. Preiser-Kapeller (note 22) for further bibliography.

26 Ioannis G. Telelis Μετεωρολογικά φαινόμενα και κλίμα στο Βυζάντιο. 2 vols., Athens 2004. Cf. also Ioannis G. Telelis, Climatic Fluctuations in the Eastern Mediterranean and the Middle East AD 300–1500 from Byzantine Documentary and Proxy Physical Paleoclimatic Evidence – a Comparison, in: Jahrbuch der Österreichischen Byzantinistik 58 (2008), pp. 167–207; Idem, Medieval Warm Periods and the Beginning of the Little Ice Age in the Eastern Mediterranean: An Approach of Physical and Anthropogenic Evidence, in: Klaus Belke/ Friedrich Hild/ Johannes Koder/ Peter Soustal (eds.),

increasing number of studies have contributed a variety of proxy data from "archives of nature" for the ancient and medieval Mediterranean. One focal point of these efforts has become the "Climate Change and History Research Initiative," founded, among others, by the Byzantinist John F. Haldon at Princeton. Publications emerging from this group include a special issue of Quaternary Science Reviews in 2016 and a special issue of Human Ecology in 2018.[27] The 2016 issue also contained an insightful programmatic paper by Adam Izdebski et al. on the dialogue between historians and paleoclimatologists.[28] Izdebski has also pioneered the large-scale introduction of palynological data into the study of the Byzantine economy, both in a monograph on Asia Minor[29] and in a major paper co-authored with Grzegorz Koloch and Tymon Słoczyński, which re-evaluated and also re-dated pollen data from dozens of sites in Asia Minor and the Balkans and created synthetic trajectories of the trends of cultivation of various crops such as wheat, grapes, or olives for seven larger regions: central Greece, the highland hinterlands of Macedonia, the mountains of western Bulgaria, eastern Bulgaria, eastern Bithynia, inland Pontus, and southwestern Anatolia (with a focus on Pisidia) (see Figure 1 and Figure 8–10). Most recently, Adam Izdebski in summer 2018 has established an independent research group at the Max Planck Institute for the Science of Human History in Jena, entitled "Byzantine Resilience: Environmental History of the Eastern Romans (ByzRes)"; it focuses on those regions in Greece and in Western Turkey which are also of special interest for the period discussed in the present paper and therefore will constitute a decisive step forward for answering questions which have to remain open for now due to the lack of data (see

Byzanz als Raum. Zu Methoden und Inhalten der historischen Geographie des östlichen Mittelmeerraumes, Vienna 2000, pp. 223–243.

27 Haldon et al. (note 24). Alexandra Gogou / Adam Izdebski / Karin Holmgren (eds.), Special Issue: Mediterranean Holocene Climate, Environment and Human Societies, in: Quaternary Science Reviews 136 (2016), pp. 1–252, there especially the papers: Elena Xoplaki et al., The Medieval Climate Anomaly and Byzantium: A review of the evidence on climatic fluctuations, economic performance and societal change, in: Quaternary Science Reviews 136 (2016), pp. 229–252; Erika Weiberg et al., The socio-environmental history of the Peloponnese during the Holocene: Towards an integrated understanding of the past, in: Quaternary Science Reviews 136 (2016), pp. 40–65. John F. Haldon et al. (eds.), Special Issue: Society and environment in the East Mediterranean ca 300–1800 CE. Resilience, adaptation, transformation, in: Human Ecology 46/3 (2018), pp. 273–398. For the "Climate Change and History Research Initiative" see: http://climatechangeandhistory.princeton.edu/ and also the bibliography via https://climatechangeandhistory.princeton.edu/bibliographies (last time accessed 07/01/2019). One of the authors of the present paper (Johannes Preiser-Kapeller) is also a member of this initiative and has contributed to the special issue of Human Ecology.

28 Adam Izdebski et al., Realising consilience: How better communication between archaeologists, historians and natural scientists can transform the study of past climate change in the Mediterranean, in: Quaternary Science Reviews 136 (2016), pp. 5–22.

29 Izdebski (note 23).

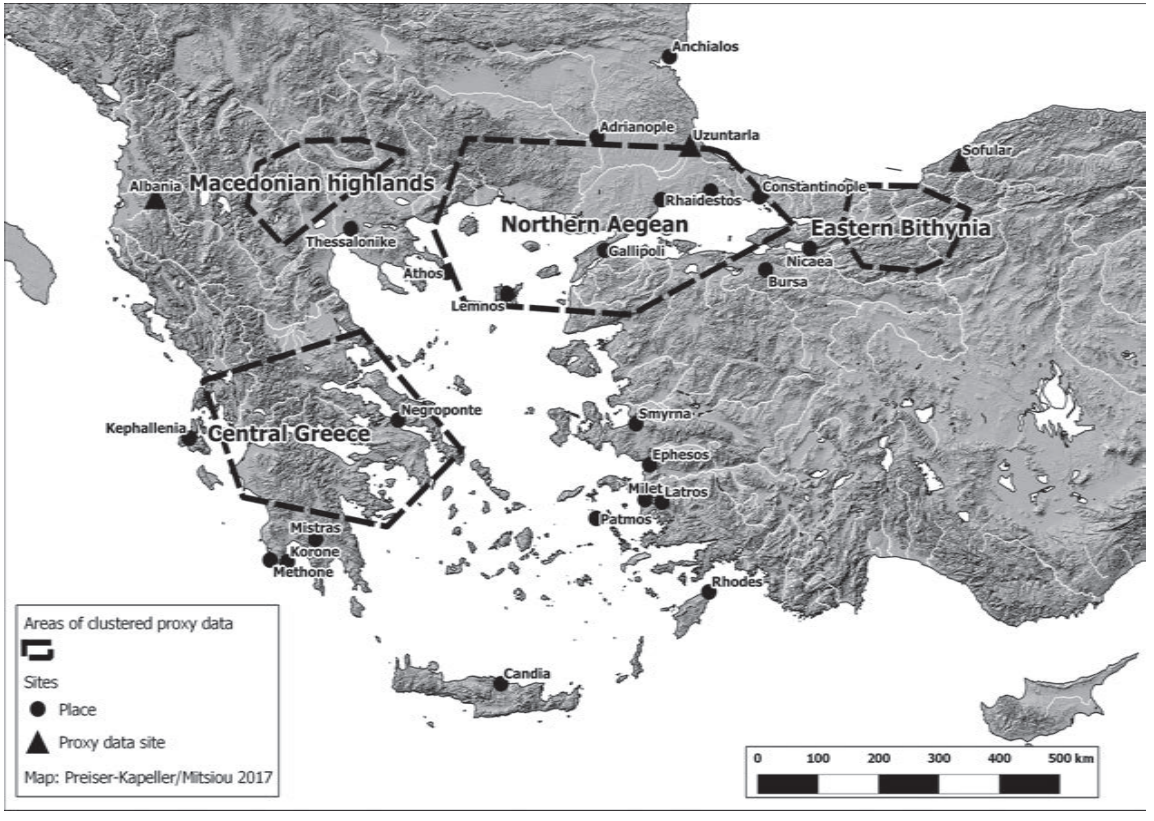

Figure 1: – Map of selected historical places and proxy data sites as well as of areas of clustered proxy data mentioned in the paper (image: Preiser-Kapeller/ Mitsiou 2017; see also Xoplaki et al. [note 27], Figure 1, for a similar map of places of origin of proxy data).

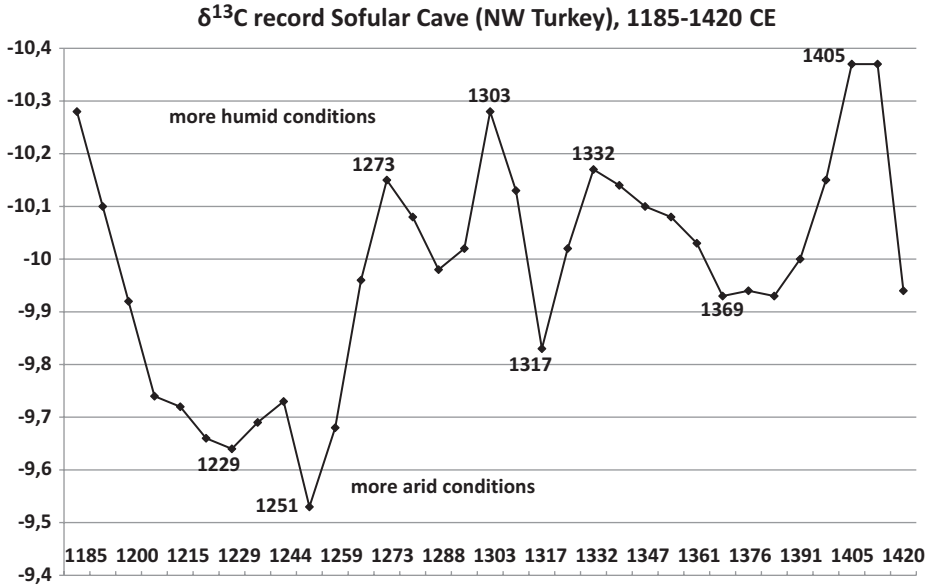

Figure 2: – $\delta^{13}C$ record from speleothems in the Sofular Cave (NW Turkey), 1185–1420 (data: Fleitmann et. al. [note 32]; image: Preiser-Kapeller/ Mitsiou 2017).

also below).[30] Of course, scholars working outside the Princeton research initiative have also published various relevant studies: most interestingly, Edward R. Cook et al. present spatial reconstructions of summer wetness and dryness across Europe and the Mediterranean for the last two thousand years in the "Old World Drought Atlas" (OWDA) based on tree ring data; for the period under consideration, the OWDA includes the eastern Mediterranean, as well.[31]

All this new data allows us to re-evaluate the possible impact of the transition from the Medieval Climate Anomaly to the Little Ice Age on the late Byzantine Empire; as illuminating examples, we have visualized four groups of proxies (see Figure 1): the pollen data provided by Izdebski/ Koloch/ Słoczyński (see Figure 8–10), the carbon isotope record from speleothems in the Sofular Cave (northwest Turkey) (see Figure 2–3) as well as tree ring data for Albania (see Figure 4–5) and the northern Aegean (see Figure 6–7) (in addition to other proxy data discussed throughout the

30 Adam Izdebski/ Grzegorz Koloch/ Tymon Słoczyński, Exploring Byzantine and Ottoman economic history with the use of palynological data: a quantitative approach, in: Jahrbuch der Österreichischen Byzantinistik 65 (2015), pp. 67–110. For the new project of Adam Izdebski in Jena see: https://www.shh.mpg.de/1056512/byzres (last time accessed 07/01/2019).

31 Edward R. Cook et al., Old World megadroughts and pluvials during the Common Era, in: Science Advance, November 2015 (DOI: 10.1126/sciadv.1500561).

paper).[32] Climate proxies and pollen data cannot answer some questions discussed within this context, such as the actual impact of the rise of great estates, but they can provide a general environmental framework within which Byzantium and other polities operated in the thirteenth and fourteenth centuries, and they provide additional data on the increase or decrease of agricultural activity in various regions which can be compared with historical records. The following sections of this paper try to do just that. Although the findings are at times exploratory and additional data and research are clearly necessary, these preliminary findings highlight the potential of combining these archives of society and of nature for a further re-evaluation of the development of Byzantium in the thirteenth and fourteenth centuries.

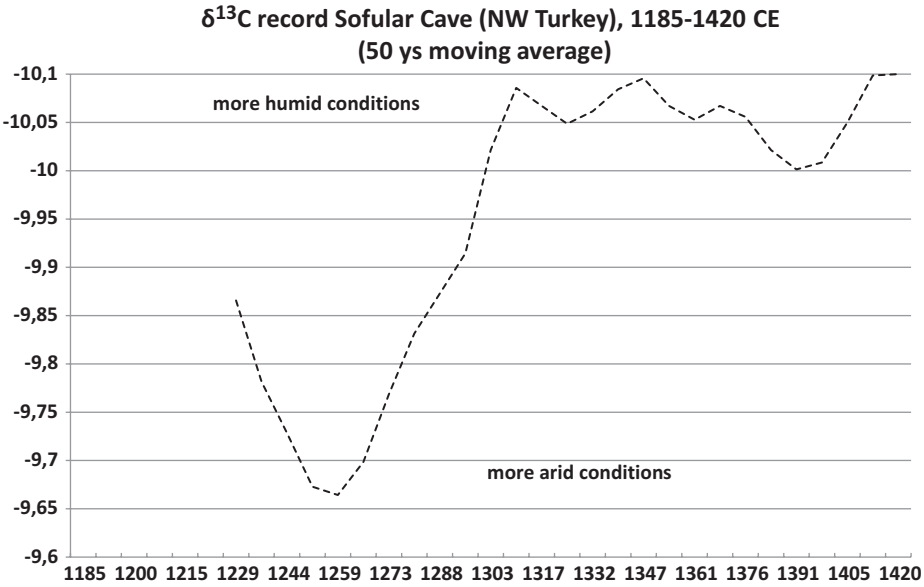

Figure 3: – $\delta^{13}C$ record from speleothems in the Sofular Cave (NW Turkey), 1185–1420, 50 years moving average (data: Fleitmann et. al. [note 32]; image: Preiser-Kapeller/ Mitsiou 2017).

32 For the Sofular-data: Dominik Fleitmann et al., Sofular Cave, Turkey 50KYr Stalagmite Stable Isotope Data. IGBP PAGES/World Data Center for Paleoclimatology Data Contribution Series # 2009–132 (ftp://ftp.ncdc.noaa.gov/pub/data/paleo/speleothem/asia/turkey/sofular2009.txt, last time accessed 20/09/2017), and Ozan M. Göktürk, Climate in the Eastern Mediterranean through the Holocene inferred from Turkish Stalagmites, Ph.D.-Thesis, University of Bern 2011. For the tree ring data from Albania: PAGES 2k Network consortium, Database S1 - 11 April 2013 version: http://www.pages-igbp.org/workinggroups/2k-network (last time accessed 21/04/2015). For the precipitation reconstruction based on tree rings from the northern Aegean, see Carol B. Griggs et al., A regional high-frequency reconstruction of May–June precipitation in the north Aegean from oak tree rings, A.D. 1089–1989, in: International Journal of Climatology 27 (2007), pp. 1075–1089. Cf. also Preiser-Kapeller (note 22), for the earlier period between the eleventh and thirteenth century.

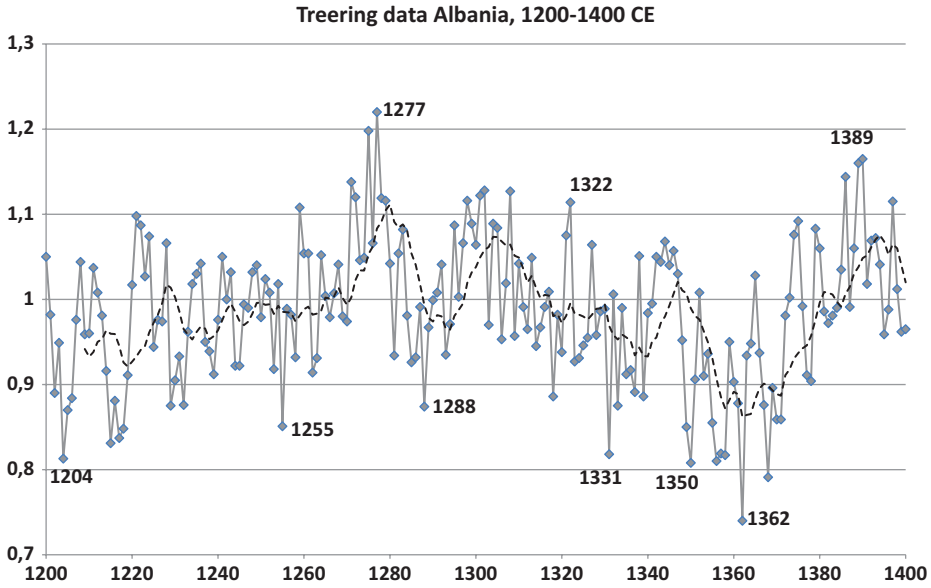

Figure 4: – Tree ring data for Albania, 1200–1400, with ten years moving average (data: PAGES 2k Network consortium, Database S1 – 11 April 2013 version: http://www.pages-igbp.org/workinggroups/2k-network [21.04.2015]; image: Preiser-Kapeller/ Mitsiou 2017).

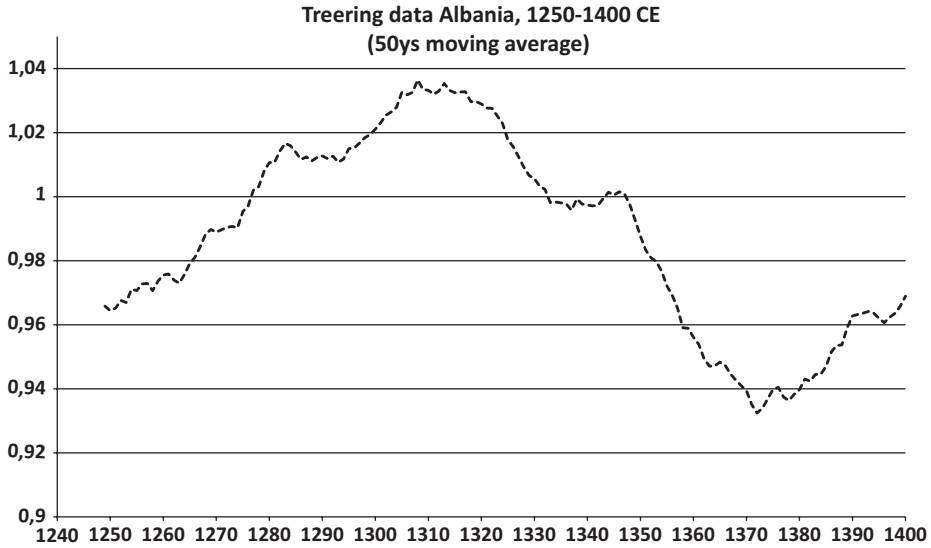

Figure 5: – Tree ring data for Albania, 1250–1400, 50 years moving average (data: PAGES 2k Network consortium, Database S1 – 11 April 2013 version: http://www.pages-igbp.org/workinggroups/2k-network [21.04.2015]; image: Preiser-Kapeller/ Mitsiou 2017).

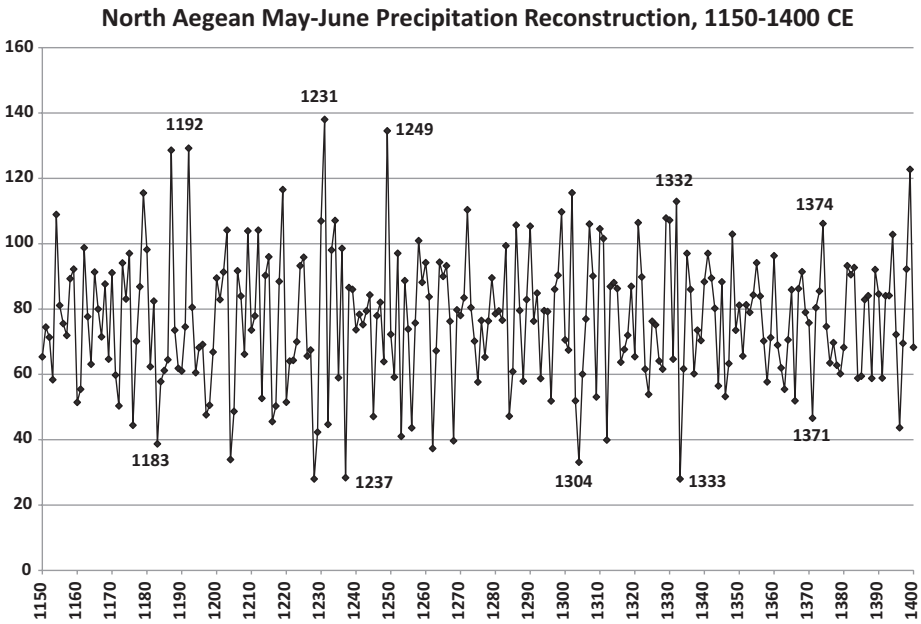

Figure 6: – Tree ring-based reconstruction of May–June precipitation in the northern Aegean, 1150–1400 (data: Griggs et al. [note 33]; image: Preiser-Kapeller/ Mitsiou 2017).

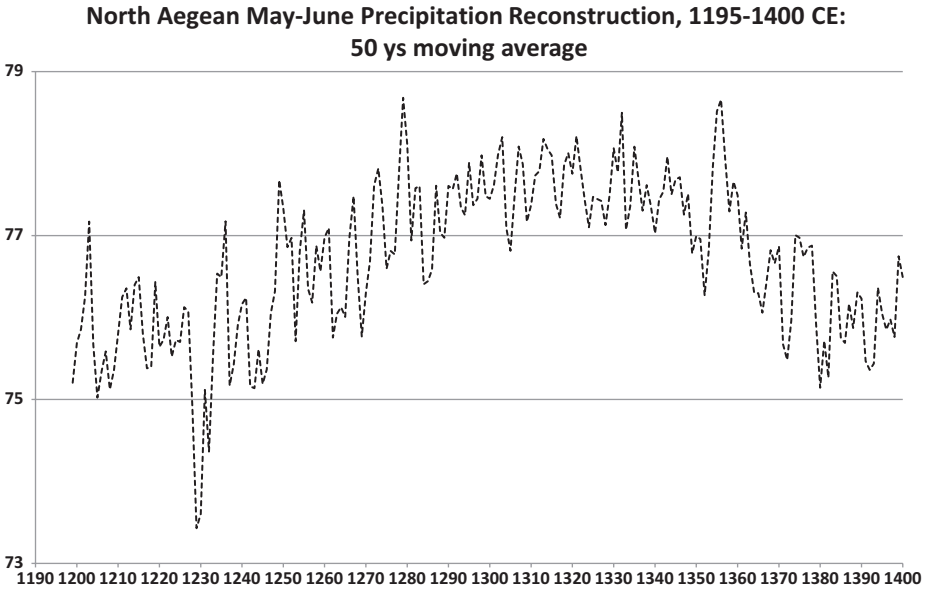

Figure 7: – Tree ring-based reconstruction of May–June precipitation in the northern Aegean, 1195–1400, 50 years moving average (data: Griggs et al. [note 33]; image: Preiser-Kapeller/ Mitsiou 2017).

3 Between Two Conquests: A Drought and a Bitterly Cold Spell, 1180–1261

The reign of Emperor Manuel I Komnenos (1143–1180) marked an apex of Byzantine influence in the Mediterranean, yet within the quarter century after his death, the empire collapsed. Various members of the imperial Komnenian family and the related clan of the Angeloi took their turns on the imperial throne, even as their power dwindled away, first in exterior provinces such as Bulgaria and Cyprus (since 1185) and finally even in core regions like the Peloponnese or western Asia Minor, where local potentates seized control. During this period, the Byzantine emperors alienated the increasingly threatening Western powers, then tried to appease them, and finally invited them to intervene in the struggles for the imperial throne, which led to the Fourth Crusade and the Crusaders' and Venetians' conquest of Constantinople in April 1204.[33] From a climate historical point of view, the Komnenian Empire of the twelfth century partly benefited from the generally favorable conditions that can be observed in other parts of the eastern Mediterranean as well as in western Europe during this period.[34] While these beneficial climatic conditions persisted (despite several severe famines) in western Europe until the thirteenth century, however, the eastern Mediterranean experienced less favorable parameters and drier conditions beginning in the middle of the twelfth century.[35] For northwestern Anatolia, proxy data (speleothems) documents a turn towards more arid conditions from the 1180s onward (see Figure 2–3). In a tree ring-based precipitation reconstruction for southwestern Anatolia for the years 1097 to 2000, Ramzi Touchan and his colleagues identified the seventy years from 1195 to 1264 as the driest period in their entire record (while the years 1098 to 1167 marked one of the wettest ones). Lake sediments from that region display an equal pattern, as do speleothems from Thrace (Uzuntarla Cave, Turkey), sediments of the Tecer Lake from Cappadocia, and pollen data from the area of Antioch, with a shift towards drier conditions beginning in the late twelfth century. This drought contributed to a severe famine in Syria between 1178 and 1181 and a prolonged drought in the Near East from 1224 to 1227.[36] In general, the years of the Angeloi

33 Charles M. Brand, Byzantium confronts the West 1180–1204, Cambridge / Mass. 1968; Michael Angold, The Fourth Crusade. Event and Context, Edinburgh 2003; Schreiner (note 1), pp. 628–630.
34 A discussion of the data supporting this scenario can be found in Preiser-Kapeller (note 22), pp. 210–216. See also Xoplaki et al. (note 27), for similar findings (up until the mid-12th century).
35 Preiser-Kapeller (note 22), pp. 214–215 (with further references).
36 Göktürk (note 32), pp. 13–39; for north-western Anatolia, see also Griggs et al. (note 32). For south-western Anatolia see Ramzi Touchan et al., May–June precipitation reconstruction of southwestern Anatolia, Turkey during the last 900 years from tree rings, in: Quaternary Research 68 (2007), pp. 196–202; Ingo Heinrich/ Ramzi Touchan et al., Winter-to-spring temperature dynamics in Turkey derived from tree rings since AD 1125, in: Climate Dynamics 41 (2013), pp. 1685–1701. For the Uzuntarla Cave in Thrace: Luterbacher et al. (note 22), pp. 104–106; Göktürk (note 32), pp. 67–80. For

(1185–1204) started to become drier and, especially in the Balkans, also colder.[37] The problems Emperor Isaak II Angelos, for instance, faced on his campaigns against insurgents in Bulgaria in the winter of 1187/88 coincide with a generally colder trend in the second half of the 1180s.[38] One may therefore ask how less beneficial or even adverse climatic parameters might have aggravated already crisis-prone conditions within a fragmenting Byzantine polity between 1180 and 1204; for a definite answer, however, more data is required.[39]

Yet after the "cosmic cataclysm" of 1204, the relative increase in power of the provinces (also due to regional economic growth) allowed for the constitution of several "Byzantine" states in exile, in northeastern Asia Minor ("Empire of Trebizond"), in northwestern Greece ("Despotate of Epirus") and most successfully, in northwestern Asia Minor ("Empire of Nicaea") by members of the landed elite (see Figure 1). In the agriculturally rich region of western Asia Minor, Theodore I Laskaris (1204–1221) and John III Dukas Vatatzes (1221–1254) were able to establish a more robust imperial government which relied on the incorporation of other elite clans, who, like the church, received tax immunities and land grants. Yet power was, for the time being, centralized around the emperor and his household.[40]

Scholarship on this age has painted a picture of "efflorescence" of the rural economy in the Empire of Nicaea based on contemporary Byzantine historiography, which describes the imperial regime as actively supporting agricultural expan-

---

Lake Tecer: Catherine Kuzucuoglu et al., Mid- to late-Holocene climate change in central Turkey: The Tecer Lake record, in: The Holocene 21/1 (2011), pp 173–188. For Antioch and Syria: David Kaniewski et al., The Medieval Climate Anomaly and the Little Ice Age in Coastal Syria inferred from Pollen-derived Palaeoclimatic Patterns, in: Global and Planetary Change 78 (2011), pp. 178–187. On the droughts of 1178–1181 and 1224–1227 and on the Near East in general, see Sara K. Raphael, Climate and Political Climate. Environmental Disasters in the Medieval Levant (Brill's Series in the History of the Environment 3), Leiden 2013, pp. 76–87 and 87–90.

37 Cf. Preiser-Kapeller (note 22) for the data.

38 Niketas Choniates p. 398, lns. 30–42, ed. J. A. Van Dieten, Nicetae Choniatae Historia (Corpus Fontium Historiae Byzantinae 11/1–2), Berlin 1975; cf. Telelis (note 26), Nr. 591, and Preiser-Kapeller (note 22), p. 215 with fn. 83 (citing the passage from Niketas Choniates at length)

39 Judith Herrin, The Collapse of the Byzantine Empire in the Twelfth Century. A Study of a Medieval Economy, updated version in: Eadem, Margins and Metropolis: Authority across the Byzantine Empire, Princeton 2013, pp. 111–129; Paul Magdalino, The Empire of the Komnenoi (1118–1204), in: Jonathan Shepard (ed.), The Cambridge History of the Byzantine Empire, c. 500–1492, Cambridge 2008, pp. 646–657, 663 (for the citation). On this period see also now Alicia Simpson (ed.), Byzantium, 1180–1204: "The sad Quarter of a Century"?, Athens 2015. As an example of the postulation of a causal interplay between climatic conditions and political crisis in this period, see Xoplaki et al. (note 27).

40 Michael Angold, A Byzantine Government in Exile. Government and Society under the Laskarids of Nicaea (1204–1261), Oxford 1975; Ekaterini Mitsiou, Untersuchungen zu Wirtschaft und Ideologie im ‚Nizänischen' Reich, Dissertation, Univ. Vienna 2006. For the term "cosmic cataclysm" (κοσμικὸς κλύδων), cf. Jean Darrouzès, Les discours d'Euthyme Tornikès (1200–1205), in: Revue des études byzantines 26 (1968), pp. 49–121, here pp. 82, ln. 28–83, ln. 1 and George Akropolites: A. Heisenberg (ed.), Georgii Acropolitae opera, I, Leipzig 1903 (revised ed. P. Wirth, Leipzig 1978), §50, p. 94, ll. 9–10.

sion, and fostering an ideal of the empire's "autarky" regarding foreign commerce, especially trade with Italian merchants.[41] These Byzantine authors, however, are clearly biased in their contrast of the "glory" days of the Laskarids with the later Palaiologos dynasty; these sources should be used with caution. For some regions of western Asia Minor, however, documents from monastic archives (especially Lembos, Latros, and Patmos, but also Athos) provide evidence of how these institutions invested in the expansion and improvement of their properties by constructing watermills or planting vineyards, for example.[42] Landholders used grapevines as a "cash crop," as Angeliki Laiou and Cécile Morrisson have pointed out, because "the price of vineyards was 5.5 to 10 times higher than that of arable land, while their fiscal value was eight to twelve times higher than that of the best-quality arable land."[43] The quantifiable data that would allow a more conclusive picture, however, is lacking: from all the regions of the Empire of Nicaea, Izdebski et al. were only able to create a synthetic pollen diagram for eastern Bithynia (southwestern Anatolia at that time was already largely beyond the grasp of Byzantine power). As they state, "vine is the only anthropogenic indicator whose values rose" from 1200 onwards (until the mid-fourteenth century), while grain and olive pollen indices remain more or less stable (see Figure 8–10).[44] Izdebski presents similar results in a recent study on the hinterland of Miletus (based on pollen data from nearby Lake Bafa in the Latros region, see Figure 1).[45] While the data so far does not support a general upwards trend of agricultural output in Nicaean lands, it at least does not show any significant impacts of the dry spell that proxy data suggests continued in western Asia Minor from the late twelfth to the middle of the thirteenth century (see also above).[46] On the one hand, the wetter regions of western Asia Minor may have been less affected than more arid areas in the interior of Anatolia, where a famine in the Seljuk realms is documented for 1243 – a famine, however, which was certainly also connected to Mongol attacks. (During this famine, the Empire of Nicaea sold grain

41 Mitsiou (note 40); Laiou/ Morrisson (note 6), p. 224.

42 Peter Thonemann, The Maeander Valley. A Historical Geography from Antiquity to Byzantium, Cambridge 2011, pp. 178–186 and pp. 263–278; Mitsiou (note 40), pp. 74–77.

43 Laiou/ Morrisson (note 6), p. 176. Cf. also Mitsiou (note 40), p. 85; Smyrlis (note 7).

44 Izdebski/ Koloch/ Słoczyński (note 31). The pollen trajectories for eastern Bithynia display a long term upwards trends since ca. 900 CE for vineyards and also for olives (until the eleventh century), perhaps at the cost of grain production, which shows a downwards trend. This may suggest that larger-scale landowners, including regional monasteries, invested in more marketable products.

45 Adam Izdebski, Environmental history of the hinterland, contribution to: Philipp Niewöhner et al., The Byzantine settlement history of Miletus and its hinterland. Quantitative Aspects: Stratigraphy, Pottery, Anthropology, Coins, and Palynology, in: Archäologischer Anzeiger 2/2016 (published 2017), pp. 225–290, here pp. 270–280.

46 Also the "Old World Drought Atlas" reconstructs years of increased summer dryness for 1204, 1216, 1228, 1232, 1237, 1243, 1244, 1245, 1250, 1251, 1253, and 1255 in western Asia Minor during the Laskarid period, cf. Cook et al. (note 31).

to the Seljuks with high profits.[47]) On the other hand, renewed political stability and a supportive government probably increased the resilience of agriculture in the face of adverse climatic conditions. A contemporary source mentions that the agrarian policy of the Laskarids aimed to lay up supplies for "times of harvest failure and shortage," and, although it is perhaps too much to assume an awareness of or an active response to changing climatic parameters, this sensible strategy may have proved even more beneficial in the first half of the thirteenth century in the regions of the Nicaean Empire.[48]

Figure 8: – Synthetic trajectories of cerealia pollen in Central Greece, Eastern Bithynia and the Macedonian highlands, 900–1500 (for each trajectory 900 = 1; data: Izdebski/ Koloch/ Słoczyński [note 31]; image: Preiser-Kapeller/ Mitsiou 2017).

47 Nikephoros Gregoras, ed. Ludwig Schopen, Bonn 1827, I, pp. 6–9, 43; Telelis (note 26), nr. 604. Telelis in his catalogue provides the relevant extracts from all the textual sources he is using. Although we have consulted and re-examined all texts (and their dating) in their original editions, we provide only references to Telelis´ monograph in most cases for the sake of brevity and clarity. This allows also for a direct comparison with other recent studies following the same way of shorthand reference such as Haldon et al. (note 24) and Xoplaki et al. (note 27).

48 Cf. Theodori Scutariotae Additamenta ad Georgii Acropolitae Historiam, in: A. Heisenberg (ed.), Georgii Acropolitae opera, I, Leipzig 1903 (revised ed. P. Wirth, Leipzig 1978), pp. 285, 23–286, 2. Cf. also Mitsiou (note 40).

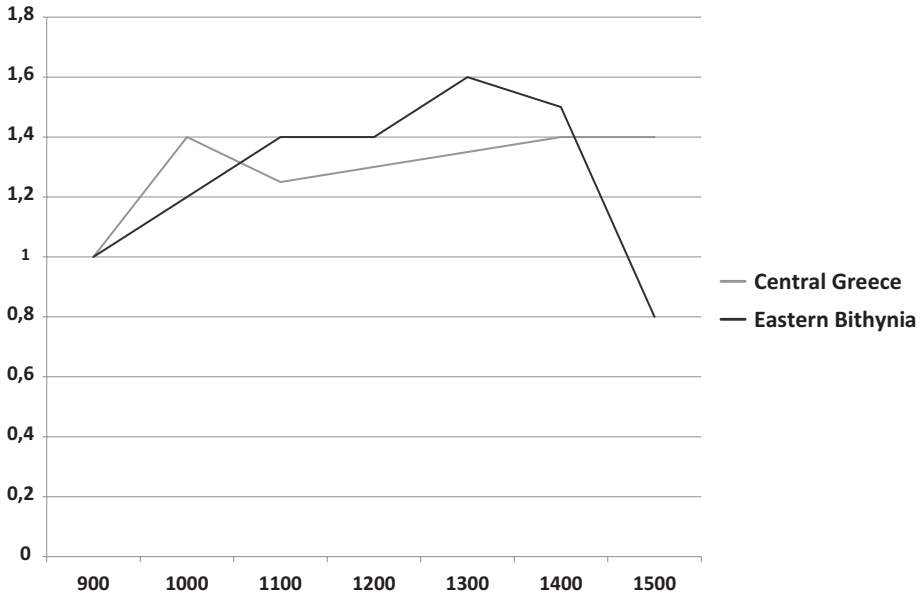

Figure 9: – Synthetic trajectories of vine pollen in Central Greece and Eastern Bithynia, 900–1500 (for each trajectory 900 = 1; data: Izdebski/ Koloch/ Słoczyński [note 31]; image: Preiser-Kapeller/ Mitsiou 2017).

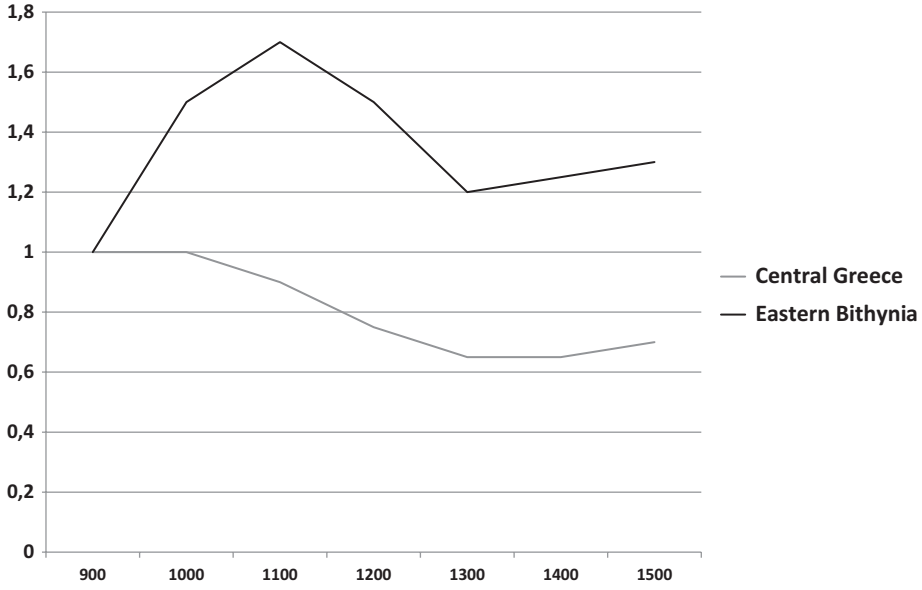

Figure 10: – Synthetic trajectories of olive pollen in Central Greece and Eastern Bithynia, 900–1500 (for each trajectory 900 = 1; data: Izdebski/ Koloch/ Słoczyński [note 31]; image: Preiser-Kapeller/ Mitsiou 2017).

Nicaea also profited from favorable geopolitical factors: powers which might have competed with Nicaea either neutralized each other or were subjugated between 1241 and 1243 by the Mongols, who never reached Nicaean territory.[49] Nicaean forces were thus able to occupy Thrace and Macedonia in the decades after 1235 and to isolate Latin-controlled Constantinople. However, the awkward equilibrium between imperial power and aristocracy proved to be short-lived; the attempt of Emperor Theodore II Laskaris (1254–1258) to rely on *homines novi* from outside the elite for his regime ended with his premature death in 1258 and the minority of his son John IV.[50] The strongest elite faction took over power in the person of Michael VIII Palaiologos (1258–1282), who gradually pushed the young John IV Laskaris aside, distributed the positions of powers among his relatives and allies, and established a new imperial dynasty.

This transfer of power from the Laskarids to the Palaiologoi chronologically overlapped with the beginning of a watershed in the general climate history of late medieval Europe, the first phase of the transition from the warmer Medieval Climate Anomaly to the Little Ice Age. A massive volcanic eruption in 1257 or 1258 (now attributed to the Samalas volcano in Indonesia) created the "single largest sulphate spike of the entire Holocene" and was a major contributor to the climate change felt in Europe. Even before this eruption, however, cold, wet conditions had begun causing harvest failures and famine in large parts of Europe.[51] Byzantine sources also report severe cold and snowfall in Thrace and Macedonia in early and late 1256, while Bar Hebraeus mentions widespread famine in Syria, Mesopotamia, and Asia Minor in 1258.[52] As severe as these problems were, as Bruce Campbell has pointed out, they were only harbingers of the more dramatic changes to come.[53]

49 Schreiner (note 1), pp. 635–638; Preiser-Kapeller (note 1), p. 74.

50 Dimiter Angelov, Imperial Ideology and Political Thought in Byzantium, 1204–1330, Cambridge 2007, pp. 204–252.

51 Père Benito i Monclús, Famines sans frontiers en Occident avant la "conjuncture de 1300". À propos d´une enquête en cours, in: Monique Bourin/ François Menant/ John Drendel (eds.), Les disettes dans la conjoncture de 1300 en Méditerranée occidentale, Rome 2011, pp. 75–79; Richard C. Hoffmann, An Environmental History of Medieval Europe (Cambridge Medieval Textbooks), Cambridge 2014, pp. 318–320, 323; Campbell (note 19), pp. 3–10 (with the citation on the Salamas eruption); Franck Lavigne et al., Source of the great A. D. 1257 mystery eruption unveiled, Samalas volcano, Rinjani Volcanic Complex, Indonesia, in: Proceedings of the National Academy of Sciences 110/42 (2013), pp. 16742–16747.

52 Telelis (note 26), nr. 606–610 (with relevant extracts from the sources).

53 Campbell (note 19), pp. 55–56.

4 A New Dynasty and towards a New Climatic Regime, ca. 1258–1300

The successes of Michael VIII's early reign, especially the unexpected reconquest of Constantinople in 1261, seemed to legitimize the Palaiologos dynasty, but with the reestablishment of the empire and the patriarchate in Constantinople, "the new Byzantine Empire took over the burdens of the big old state from before 1204."[54] The reduced empire had to provide the means for an army and diplomacy of appropriate scale for the role of a great power, which Byzantium attempted to play for the last time. The provinces in Asia Minor, the former core of the Nicaean state, were especially "neglected, heavily taxed, and suffered from Turkish attacks."[55] In the following decades between 1280 and 1330, western Asia Minor was lost almost totally to various Turkish emirates, among them the Ottomans.[56] Only Thrace and Macedonia remained as the base of a Byzantine Empire which became "a small state with reduced finances and armed forces" in southeast Europe and part of a decentralized "international" system of competing polities of medium or minor scale.[57] This fragmented political environment was held together in part by the trading network established and dominated by the Italian cities of Venice and Genoa. This network integrated Constantinople, Thessaloniki and other cities in a "World System," connecting the Mediterranean region with Asia, especially during the period of the *Pax Mongolica* between 1250 and 1350.[58] Yet the privileges of the Italian merchants, which the Palaiologoi had to acknowledge after 1261, meant that the Byzantine state budget did not fully profit from the increased volume of trade.[59] The power of the lay elite and the church, both of which also enjoyed land grants and tax privileges, further limited the state's power and resources. As a result, the eighty years of the reign of the first three Palaiologoi

54 Laiou (note 6), p. 805; Angelov (note 50), pp. 78–115.

55 Laiou (note 6), p. 805.

56 Dimitri Korobeinikov, Byzantium and the Turks in the Thirteenth Century, Oxford 2014, pp. 217–281, with further literature.

57 Angeliki Laiou, Political-Historical Survey 1204–1453, in: Elizabeth Jeffreys/ John F. Haldon/ Robin Cormack (eds.), The Oxford Handbook of Byzantine Studies, Oxford 2008, pp. 280–294, here pp. 285–286. On the Crusader states in the former Byzantine sphere cf. Peter Lock, The Franks in the Aegean 1204–1500, London, New York 1995.

58 Cf. Abu-Lughod (note 20), esp. pp. 102–134; Preiser-Kapeller (note 1), pp. 75–76 (with further literature).

59 Laiou/ Morrisson (note 6), pp. 201–215 (see also below); Klaus-Peter Matschke, Commerce, Trade, Markets, and Money: Thirteenth-Fifteenth Century, in: Angeliki Laiou (ed.), The Economic History of Byzantium. From the Seventh through the Fifteenth Century, Washington / D. C. 2002, pp. 771–806.

(Michael VIII, his son Andronikos II, and Andronikos III, 1258–1341) are considered a heyday of the landed aristocracy.[60]

Recent scholarship has examined links between the collapse of Byzantine rule in western Asia Minor and climatic factors. Elena Xoplaki et al. state: "[...] model simulations show a significant reduction in winter temperatures around the middle of the thirteenth century related to the great Samalas volcanic eruption [...] and other tropical volcanic eruptions of that period. Severe winters can damage both vineyards and olive cultivation, since [...] both of these plants are sensitive to prolonged frost and very low temperatures during winter. [...] The economic impact of such severe winters would consequently reduce the tax resources available to the local Byzantine authorities, while the imperial government from Nicaea was too busy with the recovery of the control of Constantinople to deal with local problems in western Anatolia".[61] In fact, tree rings indicate "a higher frequency of cold or extremely cold months/seasons for AD 1251–1300" in western Asia Minor.[62] Byzantine sources report severe cold and storms in the years 1265, 1277, and 1297–1298. Also the years around 1300, which brought about the first decisive defeat of the Byzantine by the Ottomans in 1302, were characterized by a severe winter in 1298/1299 in Asia Minor and Syria, a drought in Asia Minor in 1302–1304, and a flooding of the Sangarios River in summer 1302.[63] Between 1303 and 1309, an influx of refugees from Asia Minor caused a famine in Constantinople, exacerbated by the fact that the Catalan Company (see below) devastated the countryside in the European provinces during this same period.[64] While the increase in observed frequency of weather extremes might be seen as having damaged cultivators in Asia Minor, the data on more enduring impacts on agriculture is inconclusive for this region. For the hinterland of Miletus, Adam Izdebski dates the "at least partial disappearance of olive cultivation" to approximately the thirteenth or fourteenth century. He also observes a "longer period of decline" of agriculture in the entire micro-region after the Turkish occupation in the fourteenth and fifteenth centuries. This he partly connects with the cooling trends of the incipient Little Ice Age in the region, but not necessarily with the last decades of the thirteenth century, which saw the collapse of Byzantine rule in the area (equally, we possess written evi-

60 Angeliki Laiou, The Byzantine Aristocracy in the Palaiologan period: a story of arrested Development, in: Viator 4 (1973), pp. 131–151; Klaus-Peter Matschke/ Franz Tinnefeld, Die Gesellschaft im späten Byzanz. Gruppen, Strukturen und Lebensformen, Cologne, Weimar, Vienna 2001, pp. 18–62.

61 Xoplaki et al. (note 27), p. 248. The reference to the "government from Nicaea" is somehow misplaced, since the imperial residence was once again located in Constantinople after 1261.

62 Xoplaki et al. (note 27), p. 236; Heinrich et al. (note 36), pp. 1685–1701.

63 Telelis (note 26), nr. 624–626. The drought of 1302 finds also parallels in central Asia (1300–1301) and in Syria and Egypt (1304); on the unusually cold temperatures in 1298–1299, see Raphael (note 36), p. 22, 103. As Martin Bauch informs us, there are also reports on parallel phenomena in northern and central Italy which he will analyze in a forthcoming publication.

64 Telelis (note 26), nr. 627 (with the relevant extracts from the sources).

dence from the fourteenth century which would qualify this scenario).[65] The pollen data from eastern Bithynia likewise displays a continuous downwards trend for olive cultivation, but as early as 1100, while the trajectory for grain is rather stable from the thirteenth to fifteenth century. Significant is the decline of vineyards from mid-fourteenth century onwards, but this could also be evidence of the cultural impact of Islamic rule (see Figure 8–10).[66] In short, though the temporal overlap between the first observable effects of the Little Ice Age and the rise of the Turkish emirates in western Asia Minor may suggest a causal relation between the one and the other, the evidence is inconclusive and the quantity and quality (especially dating) of the data is not sufficient to prove such a scenario for the time being.

At the same time, the demographic and economic growth period that had started in the European provinces of Byzantium in the tenth and eleventh centuries continued well until the first decades of the fourteenth century, as both written evidence (the lists of households in villages in Macedonia from the tax documents of the Athos monasteries, see Table 2) and proxy data (pollen trajectories for the Macedonian highlands, for instance, see Figure 8) illustrate. They also hint at a later trend reversal towards cooler conditions in comparison to Asia Minor (see below). This is not to say that they did not experience periods of dearth: a document from the Makrinitissa Monastery in Thessaly details sales of property between September 1271 and 1272 due to a "year-long general shortage of grain."[67] In this case (and maybe in others) the distress of smaller landowners worked to the advantage of larger estates and may thus have even contributed to the above-mentioned "heyday" of monastic and noble consolidation of land holdings.

Still, there are also reports of spectacular acts of imperial generosity based on what was left of the agrarian wealth of the empire in its European provinces: when Mamluk Egypt and Syria were affected by a severe drought and famine from 1295 to 1297, the "perfidious" Byzantine Emperor Andronikos II – as the Dominican Guillelmus Ade wrote – "the persecutor and ancient enemy of the Roman church, made one of the largest ships in the world and sent it loaded with grain to Alexandria. This

65 Izdebski (note 45). Venetian documents, however, illustrate a frequent export of grain from the Emirate of Menteşe established in that region throughout the fourteenth century, see Elizabeth A. Zachariadou, Trade and Crusade. Venetian Crete and the Emirates of Menteshe and Aydin (1300–1415), Venice 1983, pp. 163–165.

66 Izdebski/ Koloch/ Słoczyński (note 31). There is however ample evidence for wine consumption and the import of wine by the Turkish rulers of western Asia Minor: Zachariadou (note 65), pp. 171–172; Nicolas Trépanier, Foodways and daily life in Medieval Anatolia. A new social history, Austin 2014, pp. 101–103 and pp. 117–119.

67 Alexandra Gogou et al., Climate variability and socio-environmental changes in the northern Aegean (NE Mediterranean) during the last 1500 years, in: Quaternary Science Reviews 136 (2016), pp. 209–228. For the Makrinitissa document, see Acta Monasterii Macrinitissae, ed. Franz Miklosich/ Joseph Müller, in: Acta et diplomata Graeca medii aevi. Sacra et profana, vol. 4, Vienna 1871, pp. 399–402, here p. 400. This event is not registered in the catalogue of Telelis (note 26).

ship carried fourteen thousand mule loads of grain in addition to arms and many other things. Thus the emperor, the perfidious friend and ally of the Saracens and enemy and torment of the Romans, relieved the neediness of the Babylonians."[68] Arabic sources described this crisis in detail,[69] as well, and Marino Sanudo Torsello interprets it as God's punishment for the Mamluk's conquest of the last Crusader base of Acre in 1291.[70] But according to the Chronicle of Amadi, Emperor Andronikos II was not the only Christian power to provide relief to Egypt; Sicily and Rhodes, then still also under Byzantine rule (but soon to be conquered by the Knights Hospitallers), also sent grain.[71] Soon, however, the demise of the Byzantine Empire would have limited the possibilities for such imperial largesse.

5 The Incipient Little Ice Age, the Black Death and the Fatal Crisis of Byzantium, ca. 1300–1360

Signs of the end of economic growth in the European provinces multiply in the first decades of the fourteenth century (see again, for instance, Table 2 and Figure 8), even before the Black Death devastated the region. Periods of violent conflict – e.g. during the raids of the Catalan Company (1302–1310), with which Emperor Andronikos II had hoped to stop the Turkish advance in Asia Minor – damaged the countryside in Thrace, Macedonia, Thessaly and central Greece (see also Table 2).[72] At the same time, noble clans and soldiers fleeing to Europe from the territories lost to the Turks inflated the rows of those competing for the distribution of this reduced surplus, increasing tensions which first erupted in the civil wars between Andronikos II and his grandson

68 Guillelmus Ade, Tractatus quomodo Sarraceni sunt expugnandi, ed. and transl. G. Constanble, Washington / D. C. 2012, pp. 40–43. Western sources tended to view Andronikos II negatively due to his annulment of the Union of Churches, to which his father Michael VIII and Pope Gregory X had agreed in 1274. At the same time, since the reign of Michael VIII, Constantinople had established good diplomatic relations with the Mamluks, see Dimitri Korobeinikov, Diplomatic correspondence between Byzantium and the Mamlūk Sultanate in the fourteenth century, in: Al-Masāq. Journal of the Medieval Mediterranean 16 (2004), pp. 53–74.

69 Raphael (note 36), pp. 22–23, 90–94; Kristine Chalyan-Daffner, Natural Disasters in Mamlūk Egypt (1250–1517): Perceptions, Interpretations and Human Responses, Dissertation, University of Heidelberg 2013, pp. 566–578, both with a discussion of the Arabic sources.

70 Marino Sanudo Torsello, Liber Secretorum Fidelium Crucis, transl. Peter Lock, Farnham 2011, II, 13, pp. 370–371.

71 Chroniques d'Amadi et de Strambaldi, 1re partie: Chronique d'Amadi, ed. René de Mas-Latrie, Paris 1891, p. 233.

72 Laiou (note 6), pp. 808–810; Laiou (note 57), pp. 287–288; Lefort (note 6). See, however, the diverging trends in the numbers of households of selected villages in Table 2 for the first half of the fourteenth century, cf. also Smyrlis (note 7).

Andronikos III between 1321 and 1328.[73] The reign of the victorious Andronikos III (1328–1341) saw the loss of the remaining cities in Bithynia to the Ottomans, but also territorial expansion in Epirus and Thessaly, which incited hope for a restoration of Byzantine power, at least in Europe. The following period of civil wars between the pro-Palaiologos faction and the followers of John VI Kantakuzenos, formerly the most important confidant of Andronikos III, from 1341 to 1354, however, destroyed all these expectations. It coincided with the Black Death, which followed the trade routes from Crimea to the Mediterranean and hit Constantinople for the first time in 1347, returning in waves in the following decades.[74] Furthermore, inner-Byzantine struggles eased the establishment of a short-lived Serbian Empire under Stefan Dušan (who conquered Macedonia, Thessaly, and Epirus) – which began to disintegrate right away after his death in 1355[75] – and the beginning of Ottoman expansion in Europe after their conquest of the fortress of Tzympe in 1352 and the nearby strategically important city of Gallipoli in 1354 (see Figure 1).

As Raúl Estangüi Gómez's concluded in his recent magisterial study on the period, agriculture in the remaining Byzantine provinces in Europe in the first half of the fourteenth century faced an unfavorable context ("un context défavorable") which combined inclement climatic conditions ("inclémence climatique") and insecurity in the countryside.[76] Proxy data such as tree rings from Albania indicate a significant turn towards adverse, cooler conditions from around 1310 for the rest of the century (see Figure 4–5). The climatic extremes reported in Byzantine sources overlap significantly with those from other parts of Europe and the Mediterranean. The cold, wet years between 1315 and 1322, which brought about crop failures and the "Great Famine" in northern Europe, find their counterpart in severe cold temperatures and storms (in 1317 and in 1321 and 1322), but also droughts (in 1315 and 1317, according to the OWDA-reconstructions) in the Byzantine territories, as well as heavy snow and cloudbursts in Egypt and Syria (in 1315, 1316 – followed by a plague of locusts, and 1317–1318) and droughts (in 1318, 1319, and 1323) (see Table 1). In western and central Europe, as well as in the Byzantine Balkans, "weather inimical to humans and their possessions in fact continued past 1317 and far into the 1320s and 1330s," coinciding

73 Laiou (note 6), pp. 808–810; Laiou (note 57), pp. 287–288; Raúl Estangüi Gómez, Byzance face aux Ottomans. Exercise du pouvoir et contrôle du territoire sous les derniers Paléologues (milieu XIVe-milieu XVe siècle) (Byzantina Sorbonensia 28), Paris 2014, pp. 34–53.

74 Cf. Ole J. Benedictow, The Black Death 1346–1353. The Complete History, Woodbridge 2004, pp. 60–74; Michael W. Dols, The Second Plague Pandemic and Its Recurrences in the Middle East: 1347–1894, in: Journal of the Economic and Social History of the Orient 22/2 (1979), pp. 162–189.

75 Cf. John V. A. Fine, Jr., The Late Medieval Balkans. A Critical Survey from the Late Twelfth Century to the Ottoman Conquest, Ann Arbor 1994, pp. 345–366. In general on this period cf. Preiser-Kapeller (note 1), pp. 74–77, and Estangüi Gómez (note 73), both with further literature.

76 Estangüi Gómez (note 73), pp. 32–34, 102–114.

with the first civil war of the two Andronikoi in the 1320s.[77] Between 1315 and 1322, parts of central and northwestern Europe experienced another major calamity when a panzootic afflicted sheep and cattle. The extent of this infection is not clear; as Bruce Campbell states, "whether it penetrated south of the Alps and beyond the Pyrenees [or into the Balkans] is not known. Certainly, there are no obvious climatic or environmental reasons why Mediterranean Europe should have escaped the contagion."[78] In this case, further research is necessary for the Byzantine regions.

Richard Hoffmann warns, however, that any picture of these decades should not be painted in only the darkest colors: historians should "avoid an 'ecological fallacy,' namely the error of reasoning from a descriptive generalization to specific phenomena within the generalized class. Just because a period is labelled an 'ice age' does not mean that its every moment was chilly."[79] As a matter of fact, written evidence from this period indicates that agriculture within the former Byzantine imperial sphere could still act a surplus producer for foreign demands as it had in the century before: the Florentine merchant Francesco Balducci Pegolotti in his famous "Pratica della mercatura," written in the late 1330s, devotes a long chapter to the commerce of Constantinople and the adjacent Genoese colony of Pera (Galata) and reports that the city not only acted as a market for grain coming from harbors along the coast of the Black Sea (Kaffa, Anchialos, Maurokastron, Bitzina, Sozopolis), but also from the Thracian hinterland of Constantinople via the port of Rhaidestos (famous as a reloading point of grain since the eleventh century, see Figure 1).[80] Other sources from Florence also mention the region as a source of cereals in times of need; between 1336 and 1355, grain was imported four times from the Aegean, once from Kephallonia, once from Constantinople, once from Pera, and twice from "Turcia" (meaning the western Anatolian emirates).[81]

The fatal civil wars of the 1340s and 1350s already chronologically overlapped with another series of extreme events in the Byzantine territories and across Europe

---

77 Hoffmann (note 51), pp. 324–327; Campbell (note 19), pp. 191–198; Telelis (note 26), nr. 631–634; Raphael (note 36), pp. 96–97, 175–176; Chalyan-Daffner (note 69), pp. 546–540; Cook et al. (note 31).

78 Campbell (note 19), pp. 209–227. There are, however, indications that the panzootic spread south of the Alps, cf. Martin Bauch, Jammer und Not. Karl IV. und die natürlichen Rahmenbedingungen des 14. Jahrhunderts, in: Český Časopis Historický 115/4 (2017), pp. 983–1016, here p. 988. We thank Martin Bauch for this reference.

79 Hoffmann (note 51), p. 320.

80 Francesco Pegolotti, La pratica della mercatura. Book of Descriptions of Countries and Measures of Merchandise (The Medieval Academy of America 24), ed. by Allan Evans, Cambridge / Mass. 1936, pp. 32–54, esp. p. 42.

81 Charles M. de la Roncière, Les famines à Florence de 1280 à 1350, in: Monique Bourin/ François Menant/ John Drendel (eds.), Les disettes dans la conjoncture de 1300 en Méditerranée occidentale, Rome 2011, pp. 225–246, here p. 238.

and the Mediterranean in general (see Table 1),[82] but the situation became even more devastating with the arrival of the plague. Bruce M.S. Campbell has summed up the interplay between climate extremes and the outbreak of the epidemic across Afro-Eurasia in a recent study.[83] Coming from the Crimea, the plague first arrived in Constantinople via sea in July 1347. As Nükhet Varlik has reconstructed recently, in the fall of that year, it spread across the Aegean to Thessaloniki, the islands of Lemnos, Euboia (Negroponte), and Crete, and to the harbors of Korone (Coron) and Methone (Modon) on the Peloponnese; by 1348, it had reached Rhodes and Cyprus as well as cities inland in Anatolia such as the Ottoman capital of Bursa and Sivas.[84] As in other regions of Europe and the Mediterranean, the short- and long-term impacts on demography and economy here were dramatic. For Macedonia, one of the remaining core regions of Byzantium and even then being gradually lost to Serbian expansion, a recent study drawing on the archives of society and of nature concluded, "the Black Death was a recurring problem [...] in the decades that followed after 1348 AD [...]. Within a relatively short time, the plague resulted in considerable population loss, which had damaging effects on the economic trends. The scale of cereal cultivation in the hills surrounding the Macedonian plain declines considerably within the next one to two centuries, which presumably had to do with the dropdown of the population levels [see also Figure 8] At the same time, the pine pollen increased its share in the pollen signal, which suggests the occurrence of secondary ecological succession onto lands previously used for agricultural activities [...]. The Byzantine archival data from the Athos monasteries also show considerable population losses [see also Table 2]."[85]

The co-occurrence of these phenomena with civil war from 1341 to 1354 was most unfortunate. One might ask whether there is a causational link between negative climatic trends and internal instability, whether declining revenues from landed property aggravated intra-elite tensions, for instance, or whether the displacement of the rural population into cities and other regions increased social unrest (as it did after the loss of Asia Minor). Raúl Estangüi Gómez ascertains a widespread abandonment of dwellings ("abandon des lieux d'habitation") in this period, but the share of climate-induced hardship vis-à-vis flight due to internal warfare and invasion is hard

82 Hoffmann (note 51), pp. 324–327; Campbell (note 19), pp. 191–198; Telelis (note 26), nr. 639–665; Raphael (note 36), pp. 103–104 (in 1344–1345, heavy snow even blocked roads in the Damascus region).

83 Campbell (note 19), pp. 227–252. Already in 1337, a plague of rodents is reported in Egypt, cf. Raphael (note 36), p. 182.

84 Nükhet Varlik, Plague and Empire in the Early Modern Mediterranean World. The Ottoman Experience, 1347–1600, Cambridge 2015, pp. 99–107, with a map on p. 101; Campbell (note 19), pp. 302, 307.

85 Gogou et al. (note 69), p. 223; Izdebski/ Koloch/ Słoczyński (note 31). For a future, more nuanced and detailed study on the changes of this period in the areas of (Northern) Macedonia, cf. the results of the case study of Mihailo Popović within the project "Digitising Patterns of Power (DPP). Peripherical Mountains in the Medieval World": http://dpp.oeaw.ac.at/index.php?seite=CaseStudies&submenu=makedonien, as well as the new project of Adam Izdebski in Jena (note 30).

to estimate (see also Table 2).[86] At the same time, between 1341 and 1369 (the final Ottoman conquest of Adrianople/Edirne), Byzantium lost its remaining larger coherent territories (with exception of the "Despotate of Morea" on the Peloponnese) to states that expanded at the cost of Constantinople despite similar climatic and epidemiological challenges. At first this was Serbia and then especially the Ottomans. Climatic parameters are thus relevant but insufficient on their own to explain a polity's vicissitudes during the "Great Transformation" of the fourteenth century.[87]

6 Conclusion

Older concepts of climate determinism postulating strong linear lines of causation between climate and society and proposing "climate change as the ultimate cause of human crisis in preindustrial societies" persist in some scholarship.[88] Ecologists, however, have highlighted that the actual reaction of any ecosystem, including human societies, to environmental change depends not only on the strength and frequency of these disturbances, but also on the capability of a system to resist or to adapt to such changes.[89] For any society, one has to take into account not only the complex interplay between environmental conditions and human communities, but also the social complexity of political, economic, and cultural systems, which can process such "external" stimuli in different ways, maybe with fatal consequences, but also with adaptive measures.[90] Against this background, generalizations about

86 Estangüi Gómez (note 73), pp. 114–118. Cf. also Lefort (note 6), and Smyrlis (note 7), p. 145, who wrote: "The main tendencies are (...) clear: severe underpopulation, abandonment of previously exploited lands, and disruption of communications and commerce. Demographic decline is primarily the result of the plague that hit the Byzantine world in 1347 and kept returning every 10 years or so through the fifteenth century. The frequent warfare and raiding that depleted the population through death and enslavement contributed to the decline."

87 Cf. also Şevket Pamuk. The Black Death and the Origins of the "Great Divergence" across Europe, 1300–1600, in: European Review of Economic History 11 (2007), pp. 289–317.

88 Cf. David D. Zhang et al, Global climate change, war, and population decline in recent human history, in: Proceedings of the National Academy of Sciences 104/79 (2007), pp. 19214–19219 (also for the citation); Solomon M. Hsiang et al., Quantifying the Influence of Climate on Human Conflict, in: Science 341 (2013) doi: 10.1126/science.1235367. For a discussion of such approaches cf. Jan De Vries, Measuring the Impact of Climate on History: The Search for appropriate Methodologies, in: Journal of Interdisciplinary History 10 (1980), pp. 599–630; Curtis (note 5), pp. 7–10.

89 Michael Scheffer, Critical Transitions in Nature and Society, Princeton 2009. Cf. Preiser-Kapeller (note 22) for further bibliography.

90 Bruce M. S. Campbell, Nature as historical protagonist: environment and society in pre-industrial England, in: Economic History Review 63/2 (2010), pp. 281–314, especially on climatic factors of the fourteenth century crisis in Western Europe. Cf. Preiser-Kapeller (note 22) for further bibliography, as well as the special issue of Human Ecology ed. by Haldon et al. (note 27), for the concepts of "resilience" and "vulnerability" of past societies vis-à-vis environmental changes.

the impact of climatic conditions on historical trajectories become problematic. In her recent monograph on climate in the medieval Levant, Sarah Kate Raphael claimed that "each environmental disaster presents an almost independent case study. There is no clear pattern of behavior or policy that rulers followed."[91]

The Byzantine Empire ultimately also "adapted" to the "perfect storm"[92] of the mid-fourteenth century, although at a much reduced scale. It became a conglomerate of small territories around cities (Thessaloniki, Selymbria, the Byzantine enclave on the Peloponnese around Mistras, see Figure 1), from which various members of the Palaiologos dynasty, who continued to compete for power, ruled often more or less independently of the emperor in Constantinople. The civil wars between 1341 and 1354 reflected social tensions: the cause of John VI Kantakuzenos was generally "backed by the landed aristocracy," while the Palaiologos party was "backed by the merchants, the sailors, and the common people, especially in the cities."[93] While the aristocratic faction won the first phase of the war in 1347 (with Ottoman support), its outcome ended the heyday of landed aristocracy, since large territories including aristocratic property were lost to neighboring powers. Nevertheless, the dominance of noble families did not decrease in the small-scale, city-based Byzantium of the last century of its existence; aristocratic families (and the church) had been able to expand their property rights not only in the countryside, but also in the cities. In addition, various noble families established commercial ties with Italian merchants, became engaged in the trading business, and were thus able to maintain their aristocratic existence on this new material basis.[94]

On an individual or collective level, therefore, certain actors were able to adapt to changing circumstances to their own benefit, such as the village or the city, which surrendered to the Ottoman invaders under relatively favorable conditions, the aristocrat or abbot, who sought a compact with the Serbian or later Ottoman ruler, or the nobleman, who forged an alliance with Italian merchant forces. This, however, started a negative feedback mechanism at the level of the Byzantine polity since such strategies further eroded its ability to respond to the crisis in ways that would benefit of the empire at large. The fourteenth-century "Schumpeterian creative destruction,"[95] with

91 Raphael (note 36), pp. 55–94 and p. 189 (for the citation). Cf. also C. Ó Gráda, Famine. A short History. Princeton, Oxford 2009.

92 Cited from Campbell (note 19).

93 Laiou (note 57), pp. 289–290. Cf. Preiser-Kapeller (note 1), pp. 76–77, for further bibliography.

94 Laiou/ Morrisson (note 6), pp. 212–213; Matschke/ Tinnefeld (note 60), pp. 158–220. Cf. Preiser-Kapeller (note 1), pp. 76–77 and 99–101, for further bibliography.

95 Stephan R. A. Epstein, Freedom and Growth. The rise of states and markets in Europe, 1300–1750 (Routledge Explorations in Economic History 17), London, New York 2000, pp. 38–72, esp. p. 55. The concept of "creative destruction" was popularized by the famous Austrian economist Joseph Schumpeter (1883–1950). Smyrlis (note 7), p. 147, even assumes that: "at least in some respects, the peasants who did not fall victim to epidemic, war, and enslavement, must have found themselves in an improved position after the middle of the fourteenth century. Depopulation made manpower sought-after and land abundant. Peasants may have been able to negotiate better terms with their landlords."

Table 1: Extreme weather events registered in the catalogue of Telelis (note 26) for the period 1250–1360

Date	Months	Region(s)	Phenomena	Telelis (note 26), nrs.
1256	Jan.–Mar.	Thrace, Macedonia	Severe cold, snow	606, 607
1256	Nov.–Dec.	Thrace, Macedonia	Severe cold, snow	608, 609
1258		Asia Minor	Famine	610
1265	May	Constantinople	Severe storms, hail	611
1277/1288	Nov.–Jan.	Thrace	Severe cold	615
1297	Aug.	Constantinople	Severe storms	622
1298–1299	Dec.–Feb.	Constantinople	Severe winter	624
1301	March–May	Asia Minor	Drought	625
1302	July	Sangarios	Flooding	626
1303–1309		Constantinople	Famine	627
1317		Constantinople	Severe storms	630
1321	Dec.	Thrace	Severe cold	631
1322	Dec.	Constantinople	Severe cold	632
1325–1328	for 6 months	Constantinople	Severe winter, ice	633
1325–1328		Constantinople, Athos	Severe winter	634
1332	Feb.	Constantinople	Severe storms	636
1333	Nov.-Dec.	Thessaly	Severe winter, snow	637
1341	Nov.	Constantinople	Severe winter, snow	639
1341	Dec.	Thrace	Severe winter, snow	640
1341	Dec.	Thrace	Cloudburst, flooding	641
1341	Nov.–Dec.	Thrace	Cloudburst, snow	642
1341	Nov.–Dec.	Thrace	Ice, flooding	643
1342	March–May	Macedonia	Cloudburst, flooding	645
1342–1343	Nov.–Feb.	Thrace	Severe winter, snow	646
1343	May	Macedonia	Cloudburst, flooding	647
1343		Constantinople	Hail, crop damage	648
1344		Constantinople	Hail, crop damage	649
1346–1347	Nov.–April	Constantinople	Severe winter, snow	650

Table 1 (continued)

Date	Months	Region(s)	Phenomena	Telelis (note 26), nrs.
1346–1353		Athos	Severe winter, snow	651
1346–1371		Athos	Famine	652
1349	March	Constantinople	Thick fog	653
1349	March	Constantinople	Severe storms	654
1349	Nov.–Dec.	Macedonia	Cloudbursts	655
1350	Jan.	Macedonia	Severe cold, death of animals	656
1350	Sept.	Athos	Hail, storms, crop damage	657
1351	Sept.	Thrace	Severe storms	658
1352	Feb.	NW-Asia Minor	Severe cold	659
1352	Feb.	Sea of Marmara	Severe storms	660
1352	March–April	Constantinople	Severe cold	661
1352	May	Constantinople	Severe storms	662
1354	March	Thrace, Gallipolis	Cloudbursts, snow, cold	663
1358–1359	Dec.–Feb.	Western Asia Minor	Severe winter, snow	664

Table 2: Numbers of households for selected villages in Macedonia registered in tax lists of Athos monasteries, 1300–1409 (data: Laiou [note 7]; Lefort [note 6]).

Village	1300/1301	1320/1321	1340/1341	1409
Drymosyrta		56		35
Eleutheroi	38	26		
Gomatou (Iberon)	50	46	32	
Gomatou (Laura)	78	104		21
Hierissos (Iberon)	36	32	31	
Kato Bolbos	34	21	24	
Loroton		60		1
Melitziane	29	39	35	
Pinson		43		20
Stomion	6	17	19	

its unique combination of socio-political and environmental upheavals, left room for adaptation at the level of individual "social structures" at a rate that outran attempts to adapt at the level of the central power. Along similar lines, Nevra Necipoğlu has identified a "lack of unity and social cohesion" in the Byzantine society of this period, evident for instance during the Ottoman blockades of Thessaloniki before 1387 and of Constantinople between 1394 and 1402, when aristocratic entrepreneurs profited from the general paucity; this certainly weakened Byzantium's ability to find an answer to the internal crisis and the external threat of the Ottoman expansion.[96] It was in this context that the Byzantine Empire, however, was able to exist for another century until the Ottoman conquest of Constantinople in May 1453.

Acknowledgements This study was undertaken within the framework of the Wittgenstein-Prize-Project "Moving Byzantium: Mobility, Microstructures and Personal Agency" (PI: C. Rapp; http://rapp.univie.ac.at/) funded by the Austrian Science Fund FWF at the Institute for Medieval Research/Division for Byzantine Research of the Austrian Academy of Sciences and the Department for Byzantine and Modern Greek Studies of the University of Vienna. We also would like to thank Martin Bauch as well as the two anonymous reviewers for their insightful comments and additions to this paper.

Smyrlis thus follows a scenario developed for Western Europe by the proponents of the "Malthusian orthodoxy" (see above). In any case, due to the loss of territories, such a possible "heyday" of the agricultural workforce in Thrace or Macedonia would have taken place largely outside what was left of the Byzantine Empire.

96 Nevra Necipoğlu, Byzantium between the Ottomans and the Latins. Politics and Society in the Late Empire, Cambridge 2009, pp. 41–43, 117.

Rainer Schreg

Plague and Desertion – A Consequence of Anthropogenic Landscape Change? Archaeological Studies in Southern Germany

Abstract: The formation of villages and the introduction of systematic three-field crop rotation transformed the landscape of western central Europe in the twelfth and thirteenth centuries. These processes have often been seen as an important progress of the medieval agriculture. This paper examines these developments from the perspective of human ecology. There is some evidence to suggest a connection between village formation and the transformation of the cultural landscape in the High Middle Ages on the one hand and the Black Death in the late Middle Ages on the other. Recent archeological data suggests that these changes to the cultural landscape were in fact major factors in or preconditions for the fourteenth-century crisis.

Keywords: village formation, agriculture, open field system, plague, human ecology

1 Economic Expansion, Colonization, and Population Growth during the High Middle Ages

The eleventh to thirteenth century in central Europe was a time of rapid growth: An expanding economy produced a surplus that funded the construction of huge churches, castles, and towns. As the population grew, there were more mouths to feed, even as more and more people moved from agrarian areas into urban centers. Silver mining and increasing long-distance trade within Europe, but also in the Far East, India, and sub-Saharan Africa, were important sources of wealth,[1] but regional agrarian production was still the foundation of the economy and the central, crucial element providing

1 Ralph A. Austen, Sahara. Tausend Jahre Austausch von Ideen und Waren (Schriftenreihe der Bundeszentrale für politische Bildung 1364), Bonn 2013; Sam Nixon, The rising trade with Africa, in: Martin Carver/ Jan Klápště (eds.), The Archaeology of Medieval Europe, vol. 2: Twelfth to Sixteenth Centuries, Aarhus 2011, pp. 361–369.

Prof. Dr. Rainer Schreg, Lehrstuhl für Archäologie des Mittelalters und der Neuzeit, Institut für Archäologische Wissenschaften, Denkmalwissenschaften und Kunstgeschichte der Universität Bamberg, Am Kranen 14, 96047 Bamberg, Germany, rainer.schreg@uni-bamberg.de

Open Access. © 2020 Rainer Schreg, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-011

sustenance for the population. This agrarian system combined rain-fed grain production with animal husbandry, which yielded the manure crucial for fertilizing fallow fields.

Without any doubt, this economic expansion, agrarian production, and population growth were mutually interdependent. For a long time, historians ascribed to the idea of a Malthusian cycle and suggested that the inability of increasing agricultural production to keep pace with the growing population had culminated in the fourteenth-century agrarian crisis.[2]

Due to a lack of statistical sources, there is no confirmed demographic data for the Middle Ages, but only rough estimations and reconstructed trends that suggest that the total population may have tripled or even quadrupled between the Carolingian period and the thirteenth century.[3] Population growth is assumed based on the increasing evidence of settlements, especially in marginal landscapes. These colonization processes are notably characteristic of the High Middle Ages and reflect the growing need for arable land. At the European level, these processes included German eastward expansion as well as the *Reconquista* in Spain and the crusades to the Near East.[4] At the regional level, internal colonization pushed into marginal land such as mountains, coastal areas, and river plains. In western and central Europe, many low mountain ranges – such as the Puy-de-Dôme, the Vosges, the Palatinate Forest,[5] the

2 Compare for the idea of a crisis e. g.: Wilhelm Abel, Agrarkrisen und Agrarkonjunktur. Eine Geschichte der Land- und Ernährungswirtschaft Mitteleuropas seit dem hohen Mittelalter, Hamburg, Berlin 1966; Jan A Aertsen/ Martin Pickavé (eds.), "Herbst des Mittelalters"? Fragen zur Bewertung des 14. und 15. Jahrhunderts. Akten der 33. Kölner Mediaevistentagung (Miscellanea Mediaevalia 31), Berlin 2004; Charles R. Bowlus, Die Umweltkrise im Europa des 14. Jahrhunderts, in: Rolf Peter Sieferle (ed.), Fortschritte der Naturzerstörung (edition suhrkamp 1489 = Neue Folge 489), Frankfurt /M. 1988, pp. 13–30; John Victor Drendel (ed.), Crisis in the later Middle Ages. Beyond the Postan-Duby paradigm (The medieval countryside 13), Turnhout 2015; Frantisek Graus, Pest – Geissler – Judenmorde. Das 14. Jahrhundert als Krisenzeit (Veröffentlichungen des Max-Planck-Instituts für Geschichte 86), Göttingen 1988; Peter Schuster, Die Krise des Spätmittelalters. Zur Evidenz eines sozial- und wirtschaftgeschichtlichen Paradigmas in der Geschichtsschreibung des 20. Jahrhunderts, in: Historische Zeitschrift 269 (1999), pp. 19–55; Rainer Schreg, Die Krisen des späten Mittelalters – Perspektiven, Probleme, Potentiale, in: Falko Daim/ Detlef Gronenborn/ Rainer Schreg (eds.), Strategien zum Überleben. Umweltkrisen und ihre Bewältigung (Römisch-Germanisches Zentralmuseum - Tagungen 11), Mainz 2011, pp. 195–214.

3 David Herlihy, Outline of Population Developments in the Middle Ages, in: Bernd Herrmann/ Rolf Sprandel/ Ulf Dirlmeier (eds.), Determinanten der Bevölkerungsentwicklung im Mittelalter, Weinheim 1987, pp. 1–23; Bruce M. S. Campbell, The great transition. Climate, disease and society in the late-medieval world, Cambridge 2016, pp. 58–65.

4 Peter Erlen, Europäischer Landesausbau und mittelalterliche deutsche Ostsiedlung. Ein struktureller Vergleich zwischen Südwestfrankreich, den Niederlanden und dem Ordensland Preußen (Historische u. landeskundliche Ostmitteleuropa-Studien 9), Marburg 1992.

5 Heidi Pantermehl, Haltestelle Zentralort – Anwendung von Modellen der Zentralortsforschung auf Mittelgebirgszonen am Beispiel des Pfälzerwaldes, in: Peter Ettel/ Lukas Werther (eds.), Zentrale Orte und zentrale Räume des Frühmittelalters in Süddeutschland. Tagung des Römisch-Germanischen Zentralmuseums Mainz und der Friedrich-Schiller-Universität Jena vom 7. - 9.10.2011

Black Forest,[6] the Spessart, the Solling,[7] the Harz, the Bohemian Forest, and the Ore Mountains[8] – represent cultural landscapes characterized by rather extensive land use mainly forest economy and raising livestock. Patterns of settlement and cultivation were quite different than in neighboring agrarian landscapes that were more densely settled. Historians have typically viewed the opening of these low mountain ranges as beginning with the clearance of forests and programmed colonization of formerly unsettled landscapes under the influence of nobles or clerical authorities.

However, there is the risk of a circular argument: Models of population growth are mainly based on the idea that settlement names, regular village plans, castles, and monasteries represent the establishment of new settlements and therefore indicate the opening and clearance of previously unsettled, forested landscapes. However, the idea of a systematic clearance of forested landscapes assumes demographic growth as a precondition.

In this situation, landscape archeology and geo-archeological research provide important insights, because detailed case studies challenge common views on the nature of medieval colonization and offer new impetus for alternative interpretations.

2 New Perspectives

Recent studies in medieval landscape archeology have questioned the previously established idea that clerical or secular authorities organized the colonization. They also show that rural history is far more complex than was thought until quite recently. For a long time, scholars viewed rural life as immutable over centuries; Oswald Spengler went as far as to claim that peasants had no history.[9] For this reason, both villages and houses were regarded as conservative elements of culture. When nineteenth-century historians first became interested in rural life of the past, they expected peasant culture to be determined more by ethnic identity than by historical processes.

in Bad Neustadt an der Saale (Römisch-Germanisches Zentralmuseum - Tagungen 18), Mainz 2013, pp. 175–191.

6 Rainer Schreg, Development and abandonment of a cultural landscape - archaeology and environmental history of medieval settlements in the northern Black Forest, in: Jan Klápště/ Petr Sommer (eds.), Medieval rural settlement in marginal landscapes (Ruralia 7), Turnhout 2009, pp. 315–333.

7 Hans-Georg Stephan/ Hans Dieter Tönsmeyer, Der Solling im Mittelalter. Archäologie - Landschaft - Geschichte im Weser- und Leinebergland. Siedlungs- und Kulturlandschaftsentwicklung; die Grafen von Dassel und Nienover (Hallesche Beiträge zur Archäologie des Mittelalters und der Neuzeit 1), Dormagen 2010.

8 Hauke Kenzler, Die hoch- und spätmittelalterliche Besiedlung des Erzgebirges. Strategien zur Kolonisation eines landwirtschaftlichen Ungunstraumes (Bamberger Schriften zur Archäologie des Mittelalters und der Neuzeit 4), Bonn 2012.

9 Oswald Spengler, Der Untergang des Abendlandes, Düsseldorf 2007, p. 668.

They therefore projected the characteristics of pre-industrial nineteenth-century rural societies back in time, taking for granted the existence of villages and the feudal system in the early Middle Ages or even the Migration Period.[10]

In the mid-twentieth century, historians and geographers gradually became attuned to changes in rural institutions, as well as in systems of cultivation and village structures. Limited sources and insufficient dating methods, however, curbed these insights. Beginning in the 1980s, researchers excavated an increasing number of medieval rural settlements and started landscape research in the field of medieval archeology. New methods such as large-scale excavation with backhoes, dating by radiocarbon and OSL (optic stimulated luminescence), and remote sensing based on aerial photographs, geophysics, and LiDAR (light detection and ranging) gave archeologists more insight into rural history.[11] This research permanently transformed understanding of early and high medieval settlement patterns and established the late formation of the medieval village. In many regions, the villages that characterize the landscape of pre-industrial and modern times only developed in the eleventh or twelfth century. This is true for fertile agrarian landscapes, but there were also similar processes in marginal landscapes of medieval colonization. This new research also has significant implications for the historical role of the kind of ordinary people who typically go unnoticed. In fact, the colonization of marginal land, the transformation of the landscape, and formation of the village was essentially founded on their labor and can be explained by their own interests. Previous research has underestimated the agency of peasants because the written sources are biased by the position of authorities and therefore tend to reflect a top-down perspective.[12]

Recently, Bruce Campbell has developed a new perspective, bringing together economic stress, war, climate change – from the Medieval Climate Anomaly of the eighth to thirteenth centuries to the beginning of the Little Ice Age – and the Black Death.[13] His broad perspective may be complemented by drawing on landscape archeology. This essay contributes some thoughts based primarily on archeological studies of the medieval settlement landscape of western central Europe, or, more specifically, southwestern Germany.

---

10 Rainer Schreg, Die Archäologie des mittelalterlichen Dorfes in Süddeutschland. Probleme – Paradigmen – Desiderate, in: Siedlungsforschung. Archäologie – Geschichte – Geographie 24 (2006), pp. 141–162.

11 Rainer Schreg, Mittelalterliche Feldstrukturen in deutschen Mittelgebirgslandschaften – Forschungsfragen, Methoden und Herausforderungen für Archäologie und Geographie, in: Jan Klápště (ed.), Agrarian technology in the medieval landscape (Ruralia 10), Turnhout 2016, pp. 351–370.

12 Rainer Schreg, Uncultivated landscapes or wilderness? Early medieval land use in low mountain ranges and flood plains of Southern Germany, in: European Journal of Post-Classical Archaeologies 4 (2014), pp. 69–98.

13 Campbell (note 3).

2.1 No Unsettled Wilderness

The top-down perspective of the medieval sources and nineteenth-century historical thinking created the impression that powerful clerical or secular authorities organized medieval colonization by giving orders to open unsettled wilderness and clear forests. Recent archeological studies in low mountain ranges in western and central Europe challenge this perspective.

An increasing number of cases clearly shows that village plans were not created as part of a strategic colonization but rather were a secondary development transforming earlier settlement activity. Examples come from various landscapes, such as the Black Forest, the Austrian Waldviertel, or lower Lusatia, east of the Elbe.

Oberwürzbach, an abandoned settlement in the northern Black Forest, was, for example, a forest village with long strip plots behind the farmsteads as was typical of colonization in the eleventh/twelfth centuries. Geo-archeological research however examined early medieval land use in this area (Figure 1). Furthermore, a closer survey of the remains of the past cultural landscape found some traces of settlements distinct from the late medieval village, which probably represent an earlier dispersed settlement.[14] Only when economic changes resulted in lords and authorities having more direct control were settlements recognized as entities and given a distinct place name. Settlement names therefore do not represent the founding of a settlement per se, but rather a shift in social meaning.[15]

The abandoned settlement of Hard in the Waldviertel in Lower Austria is characterized by a regular plan of two rows of farmsteads with one prominent farmstead at the end of the rows. This larger farmstead is the only site where weaponry and artifacts indicating written literacy were found. The settlement was established in the second half of the thirteenth century and abandoned during the fourteenth century. It was clearly planned, but it does not represent the time of "colonization." In Kleinhard – a short distance away – the remains of an earlier settlement dating back to the time around 1100 have been discovered.[16]

This later formation of regular layouts within a preexisting settlement organization is also characteristic of the villages east of the Elbe. In lower Lusatia/ Niederlausitz, a formerly swampy landscape along the Neisse ongoing open-pit brown coal

14 Rainer Schreg, Würzbach – ein Waldhufendorf im Nordschwarzwald, in: Claudia Theune-Vogt et al. (ed.), Stadt – Land – Burg. Festschrift für Sabine Felgenhauer-Schmiedt zum 70. Geburtstag (Internationale Archäologie. Studia honoraria 34), Rahden / Westf. 2013, pp. 189–202.

15 Rainer Schreg, Before Colonization. Early Medieval Land-Use of Mountainous Regions in Southern and Western Germany, in: Christoph Bartels/ Claudia Küpper-Eichas (eds.), Cultural Heritage and Landscapes in Europe – Landschaften – kulturelles Erbe in Europa. Internationale Konferenz 6.-10. Juni 2007 im Deutschen Bergbau-Museum Bochum (Veröffentlichungen aus dem Deutschen Bergbau-Museum Bochum 161), Bochum 2008, pp. 293–312; Schreg (note 12).

16 Sabine Felgenhauer-Schmiedt, Hard. Ein Wüstungskomplex bei Thaya im niederösterreichischen Waldviertel (Archäologische Forschungen in Niederösterreich 6), St. Pölten 2008.

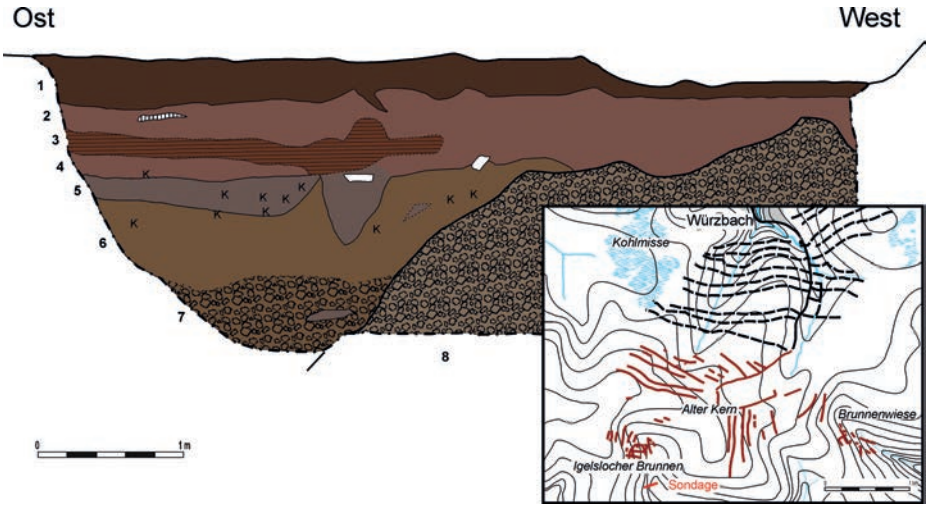

Figure 1: Geo-archeological sondage with early medieval sediments, Northern Black Forest (Graphic: R. Schreg / J. Pittori).

mining provides the opportunity for archeological research in many villages. Linear villages and green villages ("Angerdörfer") had long been associated with German eastward settlement, but archeological data shows the pre-existence of "Slavic" settlements on the one hand and the late genesis of the regular village plan on the other.[17]

Settlement activities often predate the common dating of colonization as represented by settlement forms, but also by their place names.[18] In southwestern Germany, scholars have categorized by ending and dated them using a combination of the earliest written records, early medieval burial sites, and geographical location. However, archeological settlement sites often result in finds which predate the established chronology and provide evidence of earlier settlement.

Geo-archeological research supports this idea of early activities and challenges the narrative of a pioneering colonization. In the Vosges and Palatinate Forest, as well as in the Black Forest, recent research shows early medieval soil erosion[19] patterns

17 Ines Spazier, Die Genese hoch- und spätmittelalterlicher Dörfer in der Niederlausitz, in: Felix Biermann/ Günter Mangelsdorf (eds.), Die bäuerliche Ostsiedlung des Mittelalters in Nordostdeutschland. Untersuchungen zum Landesausbau des 12. bis 14. Jahrhunderts im ländlichen Raum; Beiträge einer interdisziplinären Tagung des Lehrstuhls für Ur- und Frühgeschichte der Universität Greifswald, 16. und 17. April 2004 (Greifswalder Mitteilungen. Beiträge zur Ur- und Frühgeschichte und Mittelalterarchäologie 7), Frankfurt /M. 2005, S. 255–268.

18 Schreg (note 15).

19 Pantermehl (note 5); Thomas Knopf et al., Landnutzung im frühen Mittelalter. Eine archäopedologische Prospektion im mittleren Schwarzwald, in: Archäologisches Korrespondenzblatt 42 (2012), pp. 123–133; Rainer Schreg et al., Geoarchäologische Untersuchungen im Umfeld der Wüstung, in: Archäologische Ausgrabungen in Baden-Württemberg (2010), pp. 228–230.

indicative of human land use having destroyed the trees that, in this temperate European climate, protected the soil from erosion.[20]

In other words, the colonization of marginal land did not entail taking over unsettled wilderness but rather repurposing marginal land that had already been used for grazing, timber, firewood, and other forms of forest economy (e.g. honey production, glass industry, charcoal burning, etc.), or even mining for new, more intensive agrarian ends. The failure to consider an indigenous population, the myth of the conquest of wilderness, and the top-down perspective are all typical of an obsolete colonialist view. There are two important lessons to be learned from this:

First, we need to understand that written sources and settlement names hardly reflect rural economies. Many of the peasants' activities were beyond the scope of the written sources, which primarily served manorial interests or the trade or transfer of precious goods. Land use in marginal areas was probably of little interest to the authorities; as a result, local peasant communities were free to organize this as they saw fit. As long as this was the case, there was little need for distinct place names within the manorial written record. Conversely, the appearance of settlement names represents an increasing interest on the part of the emerging authorities.

Second, in light of these findings, we need to consider the actual human impact of colonization. Population growth was likely less significant than previously thought, and, recognizing that marginal land had some productivity even in the early Middle Ages, the growth of agrarian resources was accordingly smaller, as well. The added value of the agrarian transformation of the former marginal outlands is hard to determine. The marginal lands were not ideally suited for agriculture. At a local level, there was surely some new value created during "colonization." On the one hand, the position of medieval castles indicates that the available resources sufficed for the establishment of noble dominions, at least in some regions.[21] On the other hand, regional historical studies – on the Picardie in France, for example – point to a succession of colonization and a large number of children.[22] Obviously, peasants could exercise some agency by participating in new settlements and thereby – with some luck – improve the economic situation of their families.

---

20 Hans-Rudolf Bork, Bodenerosion und Umwelt. Verlauf, Ursachen und Folgen der mittelalterlichen und neuzeitlichen Bodenerosion, Bodenerosionsprozesse, Modelle und Simulationen (Landschaftsgenese und Landschaftsökologie 13), Braunschweig 1988.

21 Werner Meyer, Rodung, Burg und Herrschaft. Ein burgenkundlicher Beitrag zur mittelalterlichen Siedlungsgeschichte, in: Id. (ed.), Burgen aus Holz und Stein. Burgenkundlice Kolloquien, Basel 1977 (Schweizer Beiträge zur Kulturgeschichte und Archäologie des Mittelalters 5), Olten, Freiburg / Br. 1979, pp. 43–80.

22 Rolf Sprandel, Grundlinien einer mittelalterlichen Bevölkerungsentwicklung. Anmerkungen zu den 'Outlines of Population Developments in the Middle Ages' von David Herlihy aus mitteleuropäischer Sicht, in: Bernd Herrmann/ Rolf Sprandel/ Ulf Dirlmeier (eds.), Determinanten der Bevölkerungsentwicklung im Mittelalter, Weinheim 1987, pp. 25–35.

Models of a Malthusian crisis or of Bosuperian growth are obviously much too simple to explain "colonization" or medieval settlement changes more generally.

2.2 Shifting Land Use and Shifting Settlements

A crucial point in understanding medieval settlement history is the fact that settlements in the early and High Middle Ages often shifted their location. In several cases, archeological excavations have shown not only that settlements relocated in the process of forming a village out of a cluster of earlier farmsteads and hamlets, but also that they sometimes relocated repeatedly even before forming the village. It is methodologically difficult to provide evidence of possible relocations, as this requires both large-scale study of the landscape and detailed spatial analysis of pottery finds. Formation processes as strategies of waste deposits or a secondary movement of finds by erosion or modern agriculture make it difficult to trace settlement relocations by the spatial distribution of finds. However, in some cases, we can trace shifting settlements via local pottery distribution based on surface collections or patterns determined in small rescue excavations.[23]

Only a few large-scale excavations to date could provide more detailed insights into the ways that settlements actually altered over generations. An excavation at Speyer-Vogelgesang, for example, traces the relocation of farmsteads along the bluff of a river terrace above an old channel of the Rhine. Even though these farmsteads remained at the same spot for a few generations, they moved roughly 700 meters over the course of approximately 700 years.[24] Excavations at Mengen im Breisgau were too small to show the full picture of settlement relocation over time, but indicate that, in this case, farmsteads developed independently. One plausible scenario could be that two farmsteads relocated in opposite directions. Prominent examples of these shifting settlements come from landscapes adjacent to the North Sea, such as Odoorn in the Netherlands[25] or Vorbasse in Jutland.[26]

---

23 Rainer Schreg, Kontinuität und Fluktuation in früh- und hochmittelalterlichen Siedlungen, in: Carola Fey/ Steffen Krieb (eds.), Adel und Bauern in der Gesellschaft des Mittelalters. Internationales Kolloquium zum 65. Geburtstag von Werner Rösener (Studien und Texte zur Geistes- und Sozialgeschichte des Mittelalters 6), Korb 2012, pp. 137–164.

24 Ibid.

25 Harm Tjalling Waterbolk, Odoorn im frühen Mittelalter. Bericht der Grabung 1966, in: Neue Ausgrabungen und Forschungen in Niedersachsen 8 (1973), pp. 25–89.

26 Steen Hvass, The Status of the Iron Age Settlement in Denmark, in: Heinrich Beck/ Heiko Steuer (eds.), Haus und Hof in ur- und frühgeschichtlicher Zeit. Bericht über zwei Kolloquien der Kommission für die Altertumskunde Mittel- und Nordeuropas vom 24. bis 26. Mai 1990 und 20. bis 22. November 1991 (Abhandlungen der Akademie der Wissenschaften in Göttingen, Philologisch-Historische Klasse 3 218), Göttingen 1997, pp. 376–413.

More research is needed to verify this scenario of land use practices. In fact, it is difficult to understand the background of the settlements' shift, which cannot be traced through written sources. This is also true regarding the redistribution of land during the formation of the village and the introduction of open-field crop rotation. Although a vast number of written documents deals with the purchase or donation of land in the Middle Ages, there is no written evidence of organized land reform connected with the reorganization of the cultural landscape. This is a clear indication that land rights were handled on the communal level, which seems to suggest that shifting of settlements was also arranged within the illiterate local peasant community.

Similar relocations are already known in the context of prehistoric settlements, where shifting cultivation has been offered as an explanation.[27] However, these medieval farmsteads were normally relocated over small distances. They did not develop new arable land but practiced long-term crop rotation which also included the central inhabited area of the farmstead. This alternating usage of plots as settlements, gardens, fields, or even scrub fallow was probably an important strategy in maintaining fertility. The accumulation of nutrients around farmhouses was an important aspect of pre-modern soil management. Instead of bringing the dung to the fields, this system was based on bringing the fields to the fertile land around previous house sites. Unlike urban settlements, rural settlements typically had no latrines. Judging by phosphate analysis of soil samples, excrement was deposited within the farmsteads.[28]

The establishment of villages and the introduction of the open-field system meant the end of shifting settlements as a land use strategy. There was probably no initial strategy of manure-spreading to replace it; according to archeological data, the systematic collection and distribution of manure on the field was only introduced after the fourteenth-century crisis. Field archeologists are quite familiar with a common but rarely analyzed phenomenon: field-walking results in hundreds of late medieval and early modern pottery shards spread all over ploughed fields. These fragments have not been brought to the surface by modern agricultural activities destroying archeological structures in the soil but rather have lain at the surface for a very long time, which is why they are often heavily fragmented and weathered. Whereas in England or in the lower Rhine area, there is evidence of Roman or Carolingian shard

27 Schreg (note 23).

28 Rainer Schreg/ Sonja Behrendt, Phosphatanalysen in einem frühmittelalterlichen Haus in Schalkstetten (Gde. Amstetten, Alb-Donau-Kreis), in: Archäologisches Korrespondenzblatt 41 (2011), pp. 263–272.

scatters,[29] in most German landscapes, such fragments date to the fourteenth century at the earliest.[30]

2.3 The Formation of the Medieval Village

The introduction of a regulated three-field crop rotation into an open-field system was part of deeper changes in rural society. In many regions of central Europe, it was in the eleventh to thirteenth centuries that closed villages and local municipalities developed (Figure 2). Archeologically, this process of medieval village formation can be characterized as a re-arrangement of settlements in the central agrarian landscapes that had been settled early.[31] Up until this time, settlements shifted within the landscape; they stayed at the same location only a few generations and then shifted over a rather short distance. Until the eleventh to thirteenth centuries, farmsteads and hamlets scattered over some distance and established a nucleus, which afterwards stayed constant over centuries. Many villages were deserted during the following centuries, but the centers of most existing villages go back to this period of medieval village formation.

In northern France, farmsteads and hamlets first converged to form fixed villages in the tenth or eleventh century. In Bavaria, archeological data hints at the same period, whereas in modern southwestern Germany, the most prominent settlement concentration dates only to the twelfth and thirteenth centuries.[32]

This physical formation of the village also witnessed a remarkable social transformation: in the tenth century peasants were first recognized as a social class, and institutions such as the village mayor or the village commons gained in importance during the twelfth century.

---

29 Richard Jones, Signatures in the Soil. The Use of Pottery in Manure Scatters in the Identification of Medieval Arable Farming Regimes, in: Arch. Journal 161 (2005), pp. 159–188; Iris Wessel/ Christine Wohlfarth/ Renate Gerlach, Archäologische Forschungen auf der Rheinbacher Lößplatte. Ein Projekt zur Prospektion in einem geographischen Kleinraum (Rheinische Ausgrabungen 62), Mainz 2008; Nicolas Poirier, Archaeological evidence for agrarian manuring. Studying the time-space dynamics of agricultural areas with surface-collected off-sie material, in: Jan Klápště (ed.), Agrarian technology in the medieval landscape (Ruralia 10), Turnhout 2016, pp. 279–290.

30 Rainer Schreg, Mittelalterliche und neuzeitliche Funde vom Heidengraben, in: Thomas Knopf (ed.), Der Heidengraben bei Grabenstetten. Archäologische Untersuchungen zur Besiedlungsgeschichte (Universitätsforschungen zur prähistorischen Archäologie 141), Bonn 2006, pp. 201–210.

31 Rainer Schreg, Dorfgenese in Südwestdeutschland. Das Renninger Becken im Mittelalter (Materialhefte zur Archäologie in Baden-Württemberg 76), Stuttgart 2006.

32 Rainer Schreg, Siedlungen in der Peripherie des Dorfes. Ein archäologischer Forschungsbericht zur Frage der Dorfgenese in Südbayern, in: Berichte der Bayerischen Bodendenkmalpflege 50 (2009), pp. 293–317.

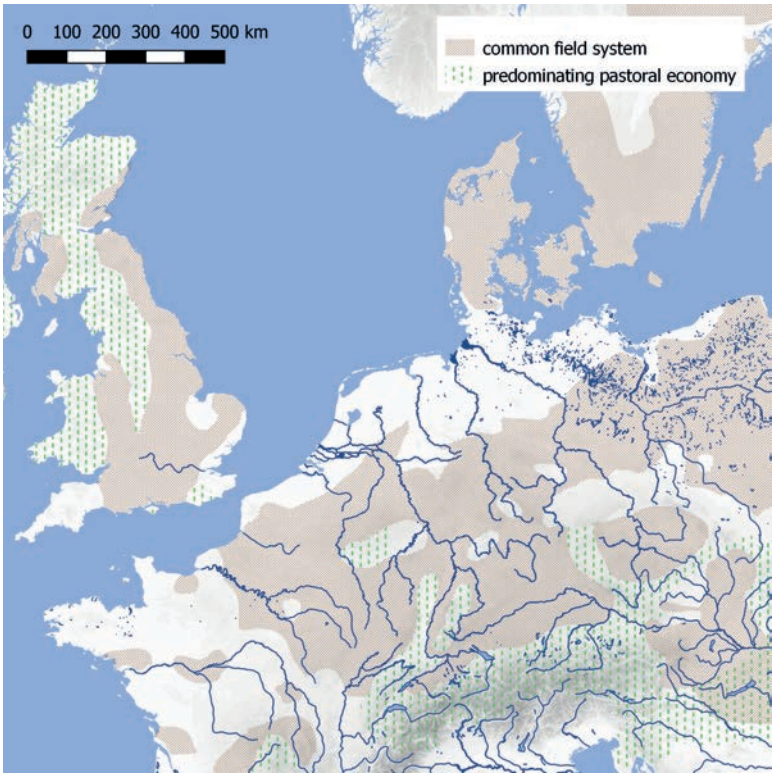

Figure 2: Agricultural systems in northwestern Europe, 13th/14th century (Graphic R. Schreg, base map SRTM, data according to Richard C. Hoffmann, An environmental history of medieval Europe [Cambridge medieval textbooks, Cambridge 2014] fig. 4.5).

Villages typically developed around a church or perhaps an older manor house. This should not necessary be read as evidence that the local secular or clerical authorities took an active role in this process. The lack of written evidence explicitly connected with village formation indicates rather that the (illiterate) local rural population was the crucial agent in this process.[33] However, village formation was a long and complex process that lasted for centuries and involved a huge number of factors and agents (Figure 3).

33 Rainer Schreg, Bauern als Akteure. Beobachtungen aus Süddeutschland, in: Jörg Drauschke/ Ewald Kislinger/ Karin Kühtreiber/ Thomas Kühtreiber/ Gabriele Scharrer-Liška/ Tivadar Vida (eds.), Lebenswelten zwischen Archäologie und Geschichte. Festschrift für Falko Daim zu seinem 65. Geburtstag (Monographien des Römisch-Germanisches Zentralmuseums 150). Mainz 2018, pp. 553–563.

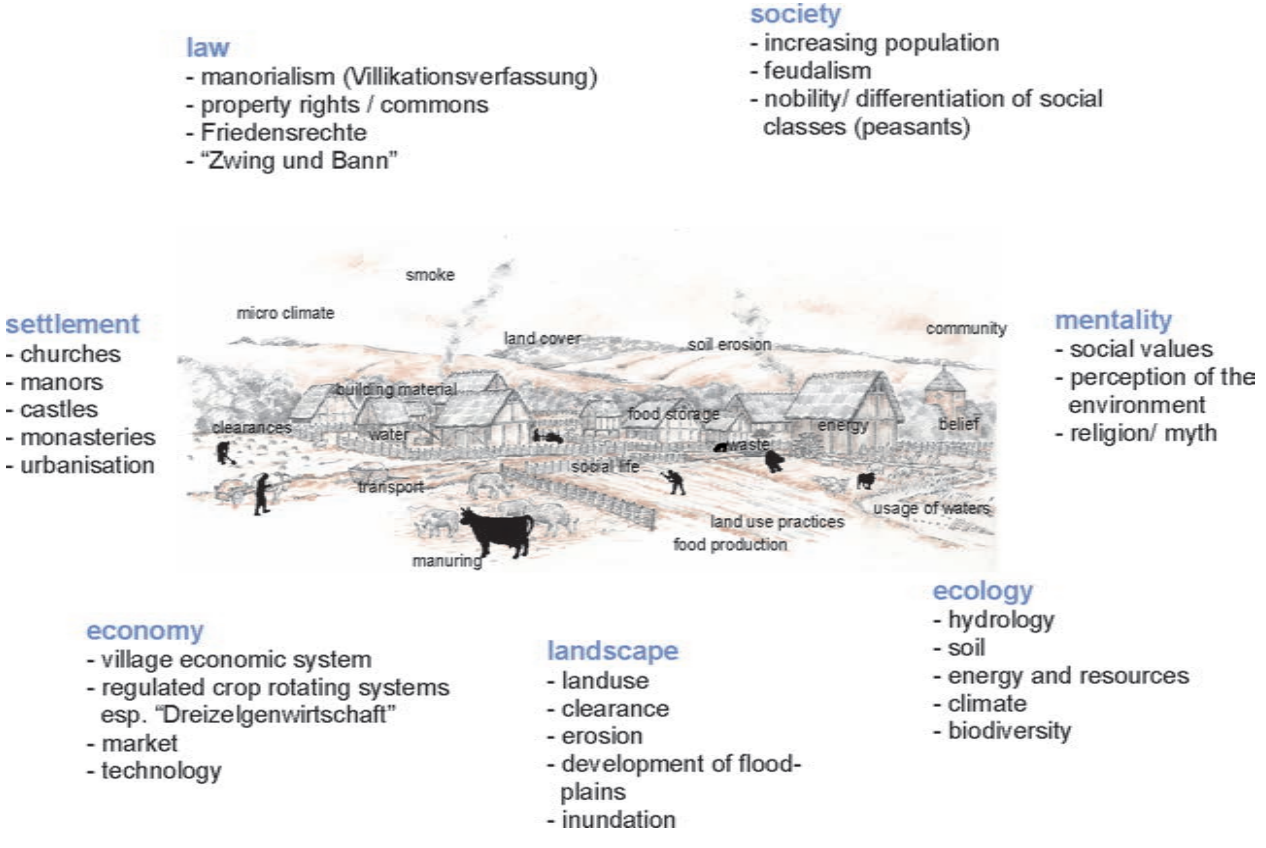

Figure 3: Factors in the formation of the medieval village (R. Schreg).

2.4 Innovation in Agrarian Technology

It was in this context that innovations in agrarian technology led to a remarkable increase of agrarian productivity. These included the invention of the moldboard or wheeled plough, the collar that improved harnesses, and the establishment of mills. Our written sources do not provide sufficient information to trace these innovate developments in detail, which is one reason that historians continue to debate over the idea of a medieval technological revolution even after decades of research.[34]

In many cases, the language of the sources does not refer explicitly to innovative features, and it is difficult to determine the date of the invention or its widespread application. The archeological record indicates some changes in the forms of ploughshares,[35] as well as the introduction of spades reinforced by metal fittings.[36] However, archeological studies on agrarian tools are more interested in the early Middle Ages than in the time period considered here.[37] Furthermore, the number of excavated late medieval abandoned settlements is quite small, and these sites often yield only a few metal artifacts, primarily nails and knives. For this reason, caution is necessary when reconstructing regional timelines of innovation.

While mills did not directly affect the productivity of the fields, they were a crucial step forward in effectively processing the harvest. Archeological evidence found in recent years indicates that watermills were invented during the early Middle Ages. There was major technological progress in the profile of the waterwheel, as well as of the millworks, but the few extant material remains do not allow a more detailed description of these innovations.[38]

Advances in agrarian technology were not restricted to tools, but also a question of land management practices such as crop rotation or pest and weed control by ploughing or draining fields. According to the written record, the commons gained

34 Lynn White, Medieval Technology and Social Change, Oxford 1962; Grenville G. Astill/ John Langdon (eds.), Medieval farming and technology. The impact of agricultural change in Northwest Europe (Technology and Change in History 1), Leiden 1997.

35 Lars Agersnap Larsen, The mouldboard plough in the Danish area 200–1500 AD, in: Jan Klápště (ed.), Agrarian technology in the medieval landscape (Ruralia 10), Turnhout 2016, pp. 225–236.

36 Janken Myrdal/Alexandra Sapoznik, Spade cultivation and intensification of land-use 1000–1300. Written sources, archaeology and images, in: Jan Klápště (ed.), Agrarian technology in the medieval landscape (Ruralia 10), Turnhout 2016, pp. 203–223.

37 E. g. Joachim Henning, Pflug. Archäologisches, in: Reallexikon der Germanischen Altertumskunde 23 (2003), pp. 104–114; Janine Claudia Fries, Vor- und frühgeschichtliche Agrartechnik auf den Britischen Inseln und dem Kontinent. Eine vergleichende Studie (Internationale Archäologie 26), Espelkamp 1995.

38 Folke Damminger, Bemerkungen zur Bedeutung von Wassermühlen im frühmittelalterlichen Südwestdeutschland, in: Hermann Ament (ed.), Studia Antiquaria. Festschrift für Niels Bantelmann zum 60. Geburtstag (Universitätsforschungen zur prähistorischen Archäologie 63), Bonn 2000, pp. 221–230.

new importance in the High and late Middle Ages,[39] which is an indication of agriculture's changing social organization. Another new development in many regions of central Europe was the invention of open-field agriculture, which transformed the medieval landscape.[40]

2.5 Open-Field Cultivation and Systematic Crop Rotation

The new three-field system (*Dreizelgen-* or *geregelte Dreifelderwirtschaft*) was characterized by compulsory crop rotation (*Flurzwang*) and some common rights on private land, such as trespassing and grazing during fallow periods.[41] Cultivation changed between fallow, winter, and spring grain over a cycle of three years. According to the written evidence, crop rotation was already known in the early Middle Ages and practiced by individual farmers on single fields. The innovation of the High Middle Ages was the coordination of this practice over the entirety of a village's agrarian land. The local peasants' commune (*Markgenossenschaft*/ G*emeinde*) controlled these regulations, which – with a few exceptions – also applied to land in the possession of nobles.[42] The dating of the introduction of the open-field system in central Europe has been the subject of much debate. Because some of the terms related to the open-field system appear even in early medieval texts, it has been considered to be an early form of land use organization. Previous research, however, has often neglected the important distinction between individual and compulsory crop rotation. The communal organization of systematic three-field crop rotation only dates back to the High Middle Ages[43] and is closely connected to the formation of villages.

This system of land management made more effective use of the available land. Neighbors could coordinate in such a way that enclosures were no longer necessary. Without this coordination, individual farmers had had to enclose their fields to prevent livestock on neighboring fields from damaging their crops; within the regulated open-field system, enclosures for the livestock during fallow periods were no longer necessary. Fences and hedges were removed, which eliminated inconvenient

39 Uwe Meiners/ Werner Rösener (eds.), Allmenden und Marken vom Mittelalter bis zur Neuzeit. Beiträge des Kolloquiums vom 18. bis 20. September 2002 im Museumsdorf Cloppenburg (Kataloge und Schriften des Museumsdorfs Cloppenburg 14), Cloppenburg 2004.

40 Hans Renes, Landscape history and archaeology of Open fields in Europe, in: Jan Klápště (ed.), Agrarian technology in the medieval landscape (Ruralia 10), Turnhout 2016, pp. 255–265.

41 Meiners/ Rösener (note 39).

42 Hans Jänichen, Markung und Allmende und die mittelalterlichen Wüstungsvorgänge im nördlichen Schwaben, in: Karl Heinz Schröder (ed.), Die Anfänge der Landgemeinde und ihr Wesen 1 (Vorträge und Forschungen 7), Sigmaringen 1986, pp. 163–222.

43 Helmut Hildebrandt, Studien zum Zelgenproblem. Untersuchungen über flürlichen Anbau aufgrund methodenkritischer Interpretationen agrargeschichtlicher Quellen aus dem deutschsprachigen Raum (Mainzer geographische Studien 14), Mainz 1980.

barriers when ploughing the fields. Because of the large turning radius of a harnessed team of draft animals, it had not been possible to plough to the very edge of the fields. In the new open-field system, however, the plough could be turned on the neighbor's field. This increased the cultivated area within fertile settled areas tremendously.

The new open-field system brought important benefits for the daily experience of peasants more so than for noble lords. The introduction of regulated crop rotation and open-field cultivation certainly had many long-term consequences; it meant both a social reorganization within rural communities regarding land ownership and regulation of agricultural practice, which gave new power to the rural elites. The open-field system was also an intensive intervention that changed the cultural landscape both in terms of appearance and ecology.

3 Long-Term Consequences

In conclusion, the many transformations of rural society, settlement patterns, agrarian technology, and the cultural landscape must be understood as a complex, long-lasting process that occurred along different paths and at different paces in different regions. These changes had consequences both for the landscape and for society. As written sources contain hardly any information about peasants' concerns, a detailed assessment is impossible. In this situation, it is helpful to understand settlements as human ecosystems (Figure 4), because this perspective makes it possible to identify possible interconnections. Teleconnections over large distances, but also in time may be understandable by looking at the ecological backgrounds. Human ecology is an interdisciplinary field of research, involving topics of demography, food, energy, resources, waste, and environment with a special focus on their interdependencies and their roles in environmental and cultural change.[44] Human behavior, although an important factor in how people recognize and deal with nature, only plays a minor role. Approaches aimed at understanding the social and cultural dimensions of human impacts on landscapes and the ecosystem are subsumed as cultural ecology.[45] Whereas human ecology most often implies a background in natural sciences, cultural ecology is rooted in the humanities.

44 Wolfgang Nentwig, Humanökologie. Fakten – Argumente – Ausblicke, Heidelberg 2005.

45 Peter Finke, Kulturökologie, in: Ansgar Nünning/ Vera Nünning (eds.), Einführung in die Kulturwissenschaften. Theoretische Grundlagen – Ansätze – Perspektiven, Stuttgart 2008, pp. 248–279.

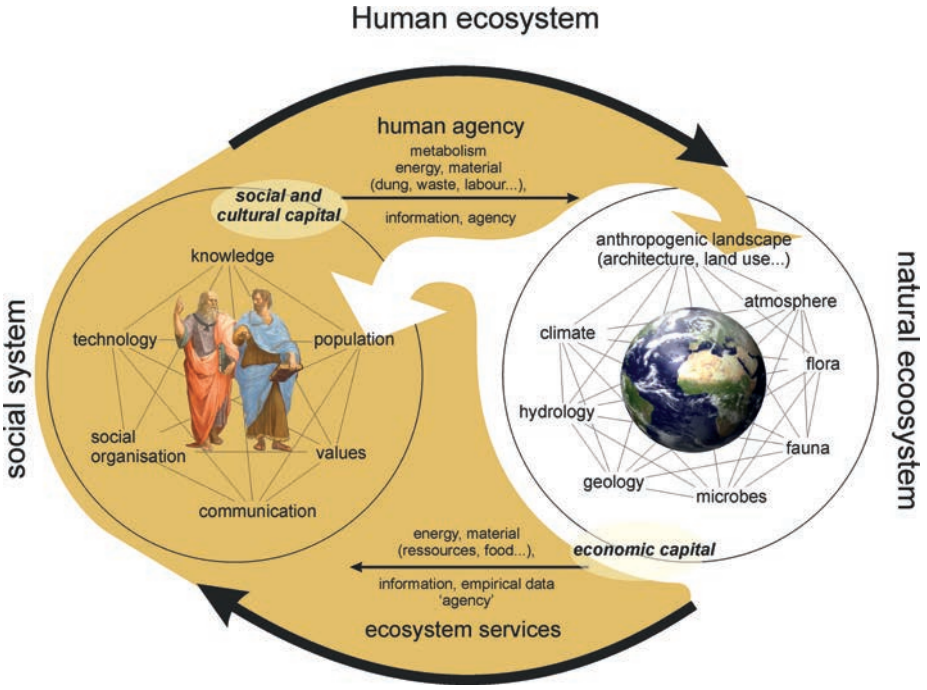

Figure 4: The idea of human ecosystem integrates the social system and the natural ecosystem and their various interrelations (R. Schreg).

The natural ecosystem comprises flora and fauna, soils, atmosphere, hydrology, and the physical landscape. These elements may already have been altered by humans and are not necessarily natural in the sense of being pristine. The social system includes everything that represents human culture: people, knowledge, technology, value systems (including religion), social organization, and communication. Societies impact their environments differently depending on their specific ideas and values. The possibilities for their behavior to influence their environment also depends largely on the technological innovations available to them. Social structures and social norms determine which methods are actually implemented. The social system and the natural system interact with each other via the exchange of energy, materials, and information.

In order to apply this theoretical concept to the fourteenth-century crisis, the focus must be on landscapes or settlements as ecosystems. In order to understand the transmission of the Black Death, we must see towns as ecosystems that include the living conditions of fleas, rats, and other small animals, systems of waste disposal, and burial customs. However, a broader understanding of the preconditions of the fourteenth-century crisis requires a closer look at rural settlements and village ecosystems. This perspective, which was first developed in environmental history in

the 1980s, leads to a better understanding of possible connections between various factors and agents.[46]

3.1 Changes in the Human Ecosystem

Thinking of medieval rural settlements as human ecosystems helps to identify several possible connections between the described processes of colonization, village formation, and open-field systems and the situation in the fourteenth century.[47] Due to the nature of the written sources, there will inevitably be gaps in some aspects of the hard historical data. The idea of human ecosystems, however, provides scenarios or models that function as hypotheses in need of verification.

In developing these hypotheses, it is not enough to identify relationships of cause and effect; we need, instead, to take into account phenomena of thresholds or retarded effects, questions of intensity, and positive and negative feedback. Within human ecosystems, the perception and reaction of human society to certain situations of stress or to emerging risks is crucial. Without modern scientific analysis, and with a pre-modern worldview, medieval humans often did not react in the way we might expect.

Understanding long-term processes requires an awareness of the chronological dimension of ecosystems. Initially, ecology postulated equilibrious states of ecosystems. As a consequence, change was seen as a disturbance that was usually the result of external influences. Nowadays, ongoing change is understood to be a basic characteristic of ecosystems. Ecosystems are complex, self-adaptive systems, with processes and dynamics resulting from the interaction of internal factors and agents.[48] However, for heuristic reasons, we must focus on selected aspects that enable us to identify possible interconnections which are verifiable with archeological or historical sources.

46 E. g. Robert McC. Netting: Balancing on an Alp. Ecological change and continuity in a Swiss mountain community, Cambridge 1981; Rainer Beck, Unterfinning. Ländliche Welt vor Anbruch der Moderne, München 2004; for an archaeological application: Rainer Schreg, Ecological approaches in medieval rural archaeology, in: European Journal of Archaeology 17 (2014), pp. 83–119.

47 Compare Rainer Schreg, Feeding the village - Reflections on the ecology and resilience of medieval rural economy, in: Jan Klápště (ed.), Food in the Medieval Rural Environment - Processing, Storage, Distribution of Food (Ruralia 8), Turnhout 2011, pp. 301–320; Schreg, (note 46).

48 Lance H. Gunderson/ C. S. Holling (eds.), Panarchy. Understanding transformations in human and natural systems, Washington / DC 2002.

3.2 The Social Impact of Open-Field Crop Rotation

The introduction of regulated three-field crop rotation required drastic changes in land ownership. A functioning open-field system necessitates equal distribution of farmland over all three zones of crop rotation. Field plots had to be exchanged between farmers to ensure that each had fields in each of the three zones.

In the past, historical and geographical research assumed that the nobility had organized the introduction of the regulated three-field system. However, this idea was rooted in the philosophy of historicism, which emphasized the role of powerful people and the state as a major driver in history. The actual sources provide little evidence to confirm this modern idea of a systematic state-driven colonization of wilderness. Rather, the data available suggests that "colonization" and the open-field system grew out of the needs of the rural population. The coordination of land use, as was necessary within a regulated open-field system, touched on basic economic interests of every single household within the settlement system. The need for equal distribution of field property over all three field blocks required a redistribution of land rights and certainly caused many conflicts. The fact that there are few documents highlighting disputes over these questions reveals a practice of land transfer very different from the common donation and sales of land to which signed charters attest. It was not noble authorities but rather local communities who oversaw this reorganization of land ownership. It is likely that this reorganization was realized within the same social organizations that had previously led the repeated shifts in settlement and field locations. Living together within village communities reshaped local societies. Municipal peasant institutions gained in importance during the twelfth and thirteenth centuries; the status of peasants and the nobility was established, and rural lower classes developed. This social process was certainly related to the urbanization occurring during this same period.[49]

One aspect that may be important for understanding the later fourteenth-century crisis is the concentration of farmsteads and people within closed villages. In earlier times, larger villages existed, but now they became characteristic in most parts of western central Europe. People lived closer together than they had previously – not just in towns, but also in the rural settlements. The lack of archeological excavations within existing villages means that we cannot trace the development of farmsteads in detail. In the long term however, the dispersed farmsteads with wooden houses, pit houses, and stilted granaries were replaced by more compact farmhouses that integrated different functions such as the stables.

49 Rainer Schreg, Die Entstehung des Dorfes um 1200. Voraussetzung und Konsequenz der Urbanisierung, in: Ralph Röber et al. (ed.), Zum Wandel der Stadt um 1200. Die bauliche und gesellschaftliche Transformation der Stadt im Hochmittelalter (Materialhefte zur Archäologie in Baden-Württemberg 96), Stuttgart 2013, pp. 47–66

3.3 The Appearance of the Landscape

Village formation and the introduction of the open-field system drastically changed the appearance of the cultural landscape (tab. 1). Hedges that had been necessary to keep livestock within the single plots during the fallow period were cut down, making it possible to turn ploughs on neighboring fields. Because these fields were cultivated in the same rhythm, turning the plough and crossing neighboring fields caused no crop damage. In effect, the space formerly occupied by hedges was adapted as space for operating the plough and use as a track. The introduction of the open -field system meant a notable increase in the total area of land cultivated.

3.3.1 Changes in Hydrology and Microclimate

The removal of hedges also changed patterns of soil erosion and the microclimate. The creation of an open-field system resulted in large areas planted in the same crops; this in turn increased heat emission and water runoff from these larger unbroken surface areas.

In addition, forested areas were cut and turned into farmland, and previously intact soil was ploughed. Geo-archeological studies in many places – e.g., the Black Forest – have shown that soil erosion increased.[50] Rates of soil erosion peaked in the fourteenth century, when the landscape was being cleared (Figure 5). In effect, the landscape lost its capacity to buffer rain water. Increased water drainage changed the fluvial dynamics of rivers and the risks of flooding.[51] The increasing importance of water mills and bridges slowed down the water runoff in creeks and rivers and led to higher groundwater levels, but also put expensive investments at risk.

3.3.2 Changed Habitats and Biodiversity

It is difficult to judge the effects of the introduction of the open -field system on flora and fauna. With its annual cycle of cultivation and moderate manuring, three-field crop rotation led to a differentiation between the plant communities of agrarian fields and grassland.[52] Studies from Scandinavia and the Rhineland show the

50 See above note 19–20.

51 Wolfgang Schirmer, Der menschliche Eingriff in den Talhaushalt, in: Kölner Jahrbuch 26 (1993), pp. 577–584; Renate Gerlach, Flußdynamik des Mains unter dem Einfluß des Menschen seit dem Spätmittelalter (Forschungen zur deutschen Landeskunde 234), Trier 1990.

52 Joachim Hüppe, Zur Entwicklung der Ackerunkrautvegetation seit dem Neolithikum, in: Natur- und Landschaftskunde 23 (1987), pp. 25–33.

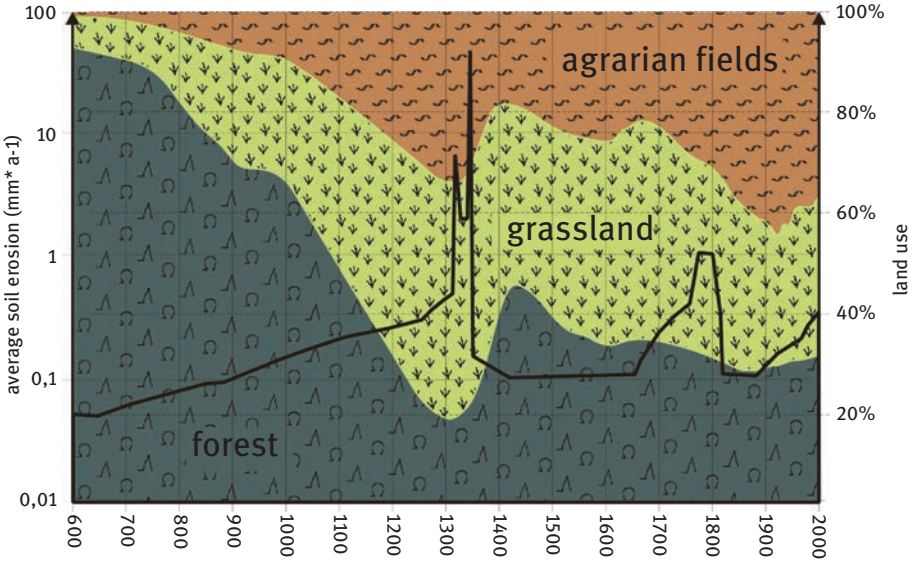

Figure 5: The development of forests, grass land, and agrarian land since the early Middle Ages in Germany, compared with the average rate of soil erosion (Hans-Rudolf Bork 2006, fig. 160).

potential of palynological data for understanding landscape development during the Middle Ages.[53] Despite an abundance of palynological and zoological data, however, a modern synthesis for central Europe is still lacking. However, in modern land consolidation, the removal of hedges has often reduced the number and diversity of birds, which in turn causes an increase in vermin.[54] It is logical to assume that their removal would have had similar repercussions in the Middle Ages. Given the lack of detailed information about the hedges and fields in the High Middle Ages, it is not currently possible to assess the actual quantitative effects. These changes may have also affected in some way the biotopes of rodents, which are known today to be carriers of disease.

53 Per Lagerås, The ecology of expansion and abandonment. Medieval and post-medieval agriculture and settlement in a landscape perspective, Stockholm 2007; Jutta Meurers-Balke et al., Landschafts- und Siedlungsgeschichte des Rheinlandes, in: Karl-Heinz Knörzer et al. (ed.), PflanzenSpuren. Archäobotanik im Rheinland: Agrarlandschaft und Nutzpflanzen im Wandel der Zeiten (Materialien zur Bodendenkmalpflege im Rheinland 10), Köln, Bonn 1999, pp. 11–66, 52–60; Wolf-Dieter Becker, Das Elsbachtal. Die Landschaftsgeschichte vom Endneolithikum bis ins Hochmittelalter (Rheinische Ausgrabungen 56), Mainz 2005.

54 Klaus Puchstein, Zur Vogelwelt der schleswig-holsteinischen Knicklandschaft mit einer ornitho-ökologischen Bewertung der Knickstrukturen, in: Corax 8 (1980), pp. 62–106.

Table 1: Hypothetical changes in the medieval settlement landscape

Landscape with enclosed plots	Open fields with three-field crop rotation
social organization	
– dispersed settlement system	– closed villages
– high individual flexibility in land use	– land use regulated by the community
	– increasing importance of the local municipality
	– changes in land property rights
landscape view	
– small mosaic of different crop	– large areas with uniform crop
– enclosures by hedges	– removal of hedges, terraces, and banks to create
– hedges, terraces, and banks to prevent strong soil erosion	– larger spaces for working with the plough
ecosystem	
– higher biodiversity, mosaic of biotopes	– increased risk of soil erosion
– diminished heat emission	– increased heat emission
– reduced evaporation	– increased water runoff and increased evaporation
– shifting settlements and long-term rotation of cultivation	– sinking groundwater levels
	– high risk in heavy weather event
	– reduced biodiversity
	– altered biotopes of rodents
	– long-term cultivation

Even though the contemporary sources offer little hard evidence, these new agricultural practices certainly introduced changes into the human ecosystem. Table 1 lists some hypothetical changes to the medieval landscape.

In the light of these landscape characteristics, one might ask whether open -field crop rotation does in fact represent great progress for medieval agrarian history. These changes obviously affected both the physical landscape and the ecosystem. Furthermore, by making the cultural landscape more vulnerable, they may have set the stage (at least in part) for the fourteenth-century crisis.

4 The Fourteenth Century – Desertion and Plague

During the fourteenth century, a series of extreme weather events struck central Europe. Within the vulnerable cultural landscape of that age, inclement or even catastrophic weather could have far-reaching consequences and result in impoverishment and increased mortality, which explains the huge number of abandoned settlements at the end of the fourteenth and the beginning of the fifteenth century. Although these late medieval deserted settlements have gained considerable attention in western central Europe, there is to date no detailed register or systematic research

beyond the excavation of specific rather small regions. The aforementioned site of Oberwürzbach, situated in the marginal land of the Black Forest, is just one example. However, it was not only in mountainous regions that settlements were abandoned; there are also numerous abandoned settlements in fertile landscapes that had been settled for some time.

Whereas Wilhelm Abel emphasized the agrarian crisis and economic factors in his explanation of the fourteenth-century crisis and the phenomenon of desertion, examining these changes to the landscape tells another story. The beginning of the fourteenth century had already seen some epizootic diseases, which may have been triggered by the landscape changes.[55] However, the situation in the summer of 1342 in particular highlights possible teleconnections between the landscape changes and the emerging crisis. In July 1342, around the feast day of Mary Magdalene, large areas – stretching at least from the Danube in Eastern Bavaria across the low mountain ranges of central Germany to the lower Rhine – were affected by a weather front that caused heavy thunderstorms and flooding at record levels never reached before or since. The inclement weather was caused by a cyclone that came from the Atlantic across the western Mediterranean and then around the eastern Alps in a northwestern direction across central Europe (the so-called "Vb-track"). This phenomenon transports huge quantities of moisture into central Europe, and such storms were responsible for floods in recent years, including the floods along the Oder in 1997, along the Elbe in 2002, and throughout central Europe in 2013.[56]

Such events can be traced in the considerable body of geo-archeological evidence on fourteenth-century soil erosion at sites ranging from southwestern Germany[57] to

55 J. Hamilton/ Richard Thomas, Pannage, pulses and pigs. Isotopic and zooarchaeological evidence for changing pig management practices in 14th century England, in: Medieval Archaeology 56 (2012), pp. 234–259.

56 Martin Bauch, Die Magdalenenflut 1342 – ein unterschätztes Jahrtausendereignis?, in: Mittelalter. Interdisziplinäre Forschung und Rezeptionsgeschichte (4.2.2014) [http://mittelalter.hypotheses.org/3016]; Hans-Rudolf Bork/ Arno Beyer/ Annegret Kranz, Der 1000-jährige Niederschlag des Jahres 1342 und seine Folgen in Mitteleuropa, in: Strategien zum Überleben, in: Falko Daim/ Detlef Gronenborn/ Rainer Schreg (eds.), Umweltkrisen und ihre Bewältigung, (Römisch-Germanisches Zentralmuseum - Tagungen 11), Mainz 2011, pp. 231–242; Gerd Tetzlaff et al., Comparison of maximum precipitation estimates with runoff depths for the 1342 and 2002 Central European flood events, in: G. Bloschl et al. (ed.), Water resources systems – hydrological risk, management and development. Proceedings of an international conference, Sapporo, Japan, 30 June to 11 July 2003 (International Association of Hydrological Sciences publication 281), Wallingford 2003, pp. 59–64.

57 Elena Beckenbach/ Uwe Niethammer/ Hartmut Seyfried, Spätmittelalterliche Starkregenereignisse und ihre geomorphologischen Kleinformen im Schönbuch (Süddeutschland). Erfassung mit hochauflösenden Fernerkundungsmethoden und sedimentologische Interpretation, in: Jahresberichte und Mitteilungen des Oberrheinischen Geologischen Vereins 95 (2013), pp. 421–438.

Franconia[58] and up to the Weser Mountains.[59] In all these cases, sediment from alluvial fans connected to erosion gullies can be dated to the fourteenth century. Near a Romanesque church which still stands in the deserted village of Winnefeld in the southern part of the Solling Mountains, approximately fifteen kilometers south of Holzminden (Lower Saxony), geo-archeological research has found indications of a severe flash flood, which destroyed a road in the settlement and washed out a gully fifteen meters wide and nearly three meters deep. The rushing water widened the floodplain of the nearby creek and swept away several houses and their contents.[60]

While the dating is not so precise as to allow ascribing this intense soil erosion to a specific event, there is a high probability that they result from the St. Mary Magdalene flood, considering the other available information on climatic events in this period.[61]

The landscape changes described above paved the way for such weather extremes to have this destructive power and cause such dramatic soil erosion. At the same time, however, there is some reason to presume that the changes to the cultural landscape themselves actually exacerbated the extreme weather: by increasing heat emission and increasing evaporation and water runoff, these changes likely made the microclimate more prone to thunderstorms.

St. Mary Magdalene's flood occurred in July 1342, just before harvest time. Heavy rain and floods distributed ripe grain over the landscape, where it was free to germinate. This likely caused a plague of rodents; although there are no written sources confirming this in this case, it is a frequently documented problem after other floods. As they fled from flooded areas, rodents searched for food in new areas including human settlements. They would have found plenty of food from the destroyed harvest, and their population presumably exploded after the flood. Seven years later, in 1349, the Black Death reached central Europe.[62] It has been confirmed that *Yersinia pestis* did in fact cause the Black Death.[63] Furthermore, we now know of its even longer history in central Europe, where it dates back to the late Neolithic and has also been linked to the Justinian plague in the sixth century. We know that *Yersinia pestis* had been endemic in Europe since prehistoric times and that over such a long time period, the

58 Markus Dotterweich, High-resolution reconstruction of a 1300 year old gully system in northern Bavaria, Germany: a basis for modelling long-term human-induced landscape evolution, in: The Holocene 15 (2005), pp. 994–1005.

59 Bork/ Beyer/ Kranz (note 56).

60 Ibid.

61 Ibid.; Bauch (note 56).

62 Ole J. Benedictow, The Black Death, 1346–1353. The complete history, Woodbridge 2004.

63 Summarizing recent research on the Black Death: Campbell (note 3); Ole Jørgen Benedictow, The Black Death and Later Plague Epidemics in the Scandinavian Countries. Perspectives and Controversies, Warsaw, Berlin 2016.

population would have developed resistance to the usual plague.[64] Shortly before the outbreak of the Black Death, however, the bacterium *Yersinia pestis* mutated in such a way[65] that the human immune system was not well adapted to fend it off. The pathogen thus become considerably more virulent.

After 1347, the plague broke out in cycles of approximately seven to eleven years.[66] That is why we must ask whether there had been a less deadly outbreak of the plague at the time of St. Magdalene's flood in 1342. It is possible that in the next cycle of plague starting 1347, the combination of the endemic germs and the fact that a new variant of *Yersinia pestis* reached Europe via the Crimea and the Italian harbors suddenly resulted in the fatal outbreak of the Black Death. The Black Death spread from Eurasia to the Black Sea in 1347, across the sea to Italian harbors, and soon to the British Isles. Mass burial sites have been found in England and southern France[67] but rarely in central Europe.[68] This is likely due, however, to different coping strategies rather than to a lower mortality.

Linking the St. Mary Magdalene's flood in 1342 with the Black Death postulates that rats were in fact the relevant intermediate hosts, a question which is admittedly still under discussion.[69] Recent research using genetics may shed new light on this matter.

5 Conclusions

This review of medieval settlement history from an archeological perspective, or more precisely, from a perspective of ecological archeology, had provided a scenario of possible long-term teleconnections (Figure 6). It links settlement changes, landscape characteristics, and land management practices of the eleventh to thirteenth centuries with weather events and the outbreak of the plague in the fourteenth century. It can be argued that systematic, regulated three-field crop rotation was not an une-

64 Simon Rasmussen et al., Early Divergent Strains of Yersinia pestis in Eurasia 5,000 Years Ago, in: Cell 163 (2015), pp. 571–582.

65 Kirsten I. Bos et al. (ed.), A draft genome of Yersinia pestis from victims of the Black Death, in: Nature 478 (2011), pp. 506–510.

66 Manfred Vasold, Die Pest. Ende eines Mythos, Darmstadt 2003, pp. 124–125.

67 Daniel Antoine, The Archaeology of ''Plague'', in: Med. Hist. Suppl. (Medical history) 27 (2008), pp. 101–114; Sacha Kacki et al., Black Death in the rural cemetery of Saint-Laurent-de-la-Cabrerisse Aude-Languedoc, southern France, 14th century. Immunological evidence, in: Journal of Archaeological Science 38 (2011), pp. 581–587

68 New evidence: Mathis Hensch, Einblick in drei Jahrtausende Siedlungsgeschichte - Ausgrabungen beim ehemaligen Bamberger Spital, in: Das Archäologische Jahr in Bayern 2017 (2018), pp. 99–102.

69 Anne Karin Hufthammer/ Lars Walløe, Rats cannot have been intermediate hosts for Yersinia pestis during medieval plague epidemics in Northern Europe, in: Journal of Archaeological Science 40 (2013), pp. 1752–1759.

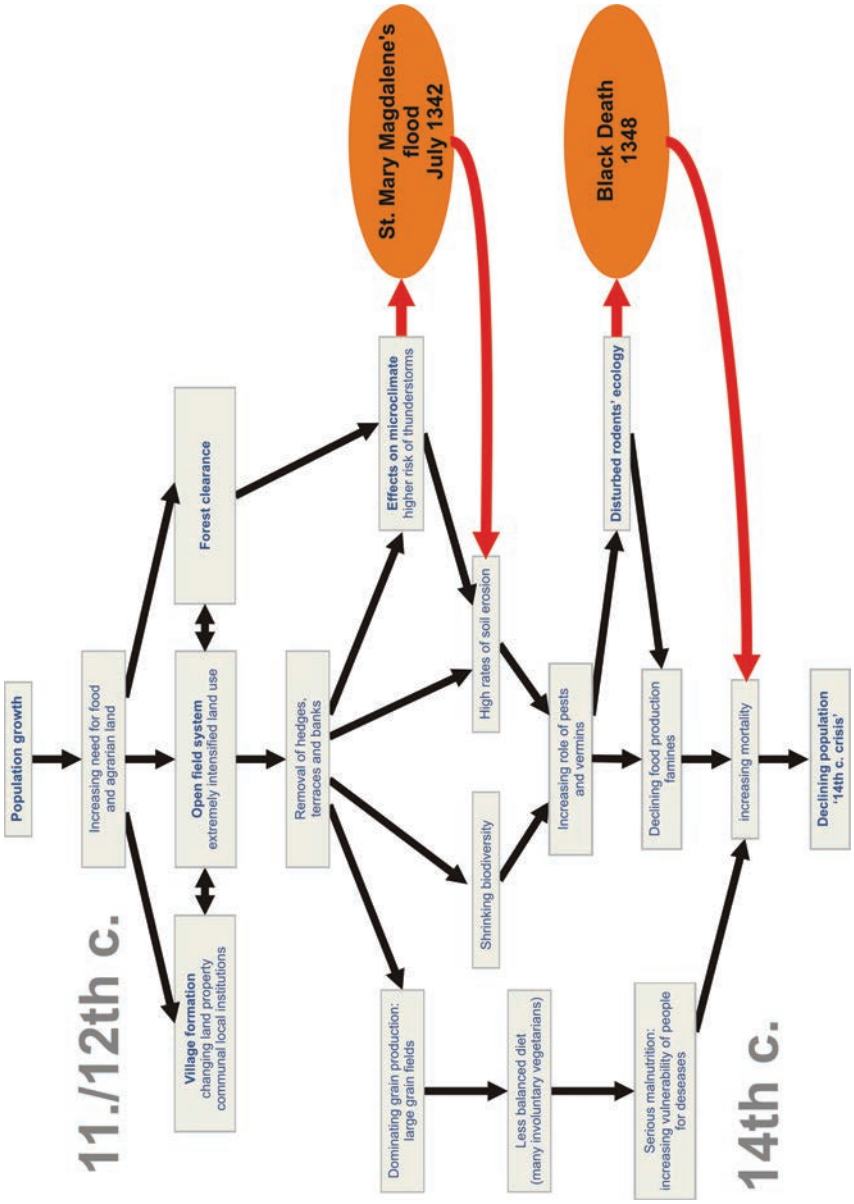

Figure 6: Possible interrelations between village formation in the 11th/12th century and the desertion of settlements and fields in the 14th century (R. Schreg).

quivocally progressive innovation of medieval agriculture, but also provided crucial preconditions for the fourteenth-century crisis. Furthermore, the Black Death was not just a spontaneous natural event but had an anthropogenic component. The vulnerable status of the cultural landscape in the fourteenth century probably favored the outbreak and transmission of disease.

Methodologically, the nature of the available sources presents a number of challenges. Because the people of the past perceived their environment differently, written sources do not generally comment directly on questions of land use practices, soil erosion, extreme weather, or infection. This necessitates the incorporation of other evidence, mostly material remains. In most cases, archeologists initially unearth such evidence, but analyzing their finds requires the cooperation of various disciplines. Purely chronological correlations are insufficient for synthesizing these various sources of data. This is not due only to the lack of a detailed chronology of the different processes, but also because current correlations of climate change and cultural history most often fail to consider the complexity of connections. The perspective of human ecology, however, can at least produce some hypotheses as it addresses quite a few factors and aspects that have not been discussed in the existing debate about the fourteenth-century crisis.

In conclusion, there is a high probability that the historic situation of landscape development in central Europe played an important role in the fourteenth-century crisis. As a long-term effect of agrarian intensification, "colonization," and village formation, the ecological system changed in ways that favored the spread of the Black Death. The introduction of open-field cultivation altered the landscape, created new risks, and increased vulnerability. In this situation, a change in the climate induced extreme weather that was fueled by the anthropogenic microclimate. The disturbance of rodents' ecology in 1342 may have affected the spread of the Black Death seven years later. The scenario presented here is nothing more than a hypothesis and an invitation to challenge old paradigms, test numerous assumptions, and deal with questions that arise from an interdisciplinary, ecological perspective.

Maximilian Schuh

Narratives of Environmental Events in the Winchester Pipe Rolls and English Historiography of the Early Fourteenth Century

Abstract: During the first half of the fourteenth century England was hit by various environmental impacts such as extreme weather events, outbreaks of murrains and Rinderpest, and flooding of coastal areas. The paper addresses the question, in what way contemporaries talked and wrote about these environmental impacts. In what way was weather described, explained and used as argument? Are there certain narrative patterns describing the effect of these events on the society? So far research focused chronicles, annals and other narrative sources to answer those questions. In contrast, manorial accounts and other documentary sources are often not seen as narrative texts but only as the source of quantifiable data. But these texts were composed in a distinct communicative setting that created certain narrative patterns. The paper identifies and analyses descriptions, explanations and arguments brought forward in this type of sources. In a second step they will compared with narrative patterns of chronicles and annals. The variety of these narratives reflects the manifoldness of their perceptions and their societal consequences.

Keywords: manorial accounts, historiography, famine, extreme weather, narrativity, perceptions of environment

1 Introduction

During the first half of the fourteenth century, England experienced a number of remarkable environmental catastrophes including extreme weather events, outbreaks of sheep murrains and cattle plague, and flooding of coastal areas.[1] To understand how these events affected contemporary society, it is important to examine how those who lived during this time perceived and recorded these events: Who spoke and wrote when, why, and how about environmental events? How did they explain them or use them as an argument? Is it possible to discern certain narrative patterns? Research to

1 Bruce M. S. Campbell (ed.), Before the Black Death. Studies in the „Crisis" of the Early Fourteenth Century, Manchester 1991; Bruce M. S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval World, Cambridge 2016.

Dr. Maximilian Schuh, Freie Universität Berlin, Friedrich-Meinecke-Institut, Koserstr. 20, 14195 Berlin, Germany maximilian.schuh@web.de

Open Access. © 2020 Maximilian Schuh, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-012

date has focused on annals, chronicles, and other narrative sources to answer these questions, while regarding demesne accounts primarily as a source of quantifiable data rather than of narratives.[2] However, the context in which accounting officials composed these documents favored certain narrative and argumentative patterns and forms of communication.[3] This paper aims to identify and analyze references to environmental events in different types of sources, comparing the narrative patterns of demesne accounts and historiographical works. This analysis allows for a better understanding of differing perspectives on environmental impacts in a premodern society and sheds light on the cultural dimensions of how people dealt with natural anomalies. This paper focuses on the era of the Great Famine[4] from 1315 onwards, as the extreme weather events of these years, which were in part responsible for the crisis, are well documented.

2 The Winchester Pipe Rolls

The Winchester Pipe Rolls are a unique body of precise documentation on agrarian production in late medieval England. Starting in 1208, the rolls contain the yearly demesne accounts of the manors belonging to the bishopric of Winchester.[5] They provide information on various aspects of the agricultural economy, making them an important source for research on the intertwining of environment and society in fourteenth-century England. For the period of the Great Famine (1315–1322), the pipe rolls provide detailed evidence of extreme weather events and their repercussions, which was written down in close temporal proximity.[6]

---

2 Kathrin Pribyl/ Richard Cornes/ Christian Pfister, Reconstructing Medieval April-July Mean Temperatures in East Anglia 1256–1431, in: Climatic Change 113 (2012), pp. 393–412; Kathleen Pribyl, Farming, Famine and Plague. The Impact of Climate in Late Medieval England, Cham 2017.

3 Maximilian Schuh, Umweltbeobachtungen oder Ausreden? Das Wetter und seine Auswirkungen in den grundherrlichen Rechnungen des Bischofs von Winchester im 14. Jahrhundert, in: Zeitschrift für Historische Forschung 43 (2016), pp. 445–471.

4 Henry S. Lucas, The Great European Famine of 1315, 1316 and 1317, in: Speculum 5 (1930), pp. 343–377; Ian Kershaw, The Great Famine and Agrarian Crisis in England 1315–1322, in: Past and Present 59 (1973), pp. 3–50; William Chester Jordan, The Great Famine. Northern Europe in the Early Fourteenth Century, Princeton 1996; Maximilian Schuh, Genderspezifische Ernährung in der spätmittelalterlichen Subsistenzkrise? Die Große Hungersnot in England (1315–1318/22), in: Medizin, Gesellschaft und Geschichte 35 (2017), pp. 17–35.

5 Richard H. Brittnell, The Winchester Pipe Rolls and Their Historians, in: Richard H. Brittnell (ed.),The Winchester Pipe Rolls and Medieval English Society, Woodbridge 2003, pp. 1–20; Bruce M. S. Campbell, A Unique Estate and a Unique Source. The Winchester Pipe Rolls in Perspective, in: Richard H. Brittnell (ed.), The Winchester Pipe Rolls and Medieval English Society, Woodbridge 2003, pp. 21–44.

6 Jan Titow, Evidence of Weather in the Account Rolls of the Bishopric of Winchester 1209–1350, in: The Economic History Review 12 (1959/60), pp. 360–407.

In the beginning of the fourteenth century, nearly sixty manors and ten boroughs, mainly situated in southeastern of England, were part of the estates belonging to the episcopal see of Winchester.[7] In a system of direct management, unfree peasants produced a huge variety of agricultural products. On each manor a reeve was responsible for organizing and overseeing this production. At the end of the agricultural year (on the 29th of September), he had to answer to the bishop's administration about the revenues, the expenses, and the stock of his manor. Auditors checked and, if necessary, corrected the account. The result of this communicative process was copied into a pipe roll, in which the accounts of all the manors for a single year were collected.[8]

The main purpose of this system was to utilize the labor obligations of unfree tenants for market-oriented agrarian production. Although labor services were not very efficient and surveillance costs were rather high, the bishops of Winchester were financially successful during the thirteenth and fourteenth century. For the agricultural year 1301/1302 their sales of grain, livestock, and other agricultural products totaled almost three thousand pounds. The yearly income from the estates alone was about five thousand pounds, which made the bishop of Winchester one of the wealthiest magnates in England.[9] The episcopal administration closely documented the management of the manors and the resulting income in the pipe rolls.[10]

Michael Postan and Jan Titow relied primarily on the Winchester Pipe Rolls for their reconstruction of late medieval agrarian society in England.[11] Titow, in particular, worked intensively with the accounts and tabulated references to weather events and their consequences. In 1960, he published a collection of these references for the years from 1219 to 1349.[12] His compilation of brief verbatim quotes from the pipe rolls have proven quite popular in historical research because they seem to provide easily accessible and reliable information on late medieval weather events.[13] Historians would do well, however, to keep in mind that these quotes are taken out of their original context and that their presentation could be misleading.

A few references from the accounts of the years from 1314/1315 to 1316/1317 serve here to illustrate these potential problems in interpretation when the context of the whole account is considered. Proxy data from the archives of nature, especially tree ring data,

7 The Pipe Roll of the Bishopric of Winchester 1301–2, ed. Mark Page (Hampshire Record Series 14), Winchester 1996, p. XII–XIII.

8 Ibid., p. XVIII–XIX; Nicholas Vincent, The Origins of the Winchester Pipe Rolls, in: Archives 21 (1998), pp. 25–42, here pp. 35–37.

9 Pipe Roll 1301–2 (note 7), p. XXII.

10 Campbell, A Unique Estate (note 5), pp. 26–29.

11 Michael M. Postan/ Jan Titow, Heriots and Prices on Winchester Manors, in: Economic History Review 11 (1958), pp. 392–417.

12 Titow (note 6).

13 For example: Kershaw (note 4), pp. 7, 15.

suggests that England received an extreme level of precipitation during this period.[14] The Old World Drought Atlas, which combines several tree ring chronologies, shows increased humidity for the summer months of June, July, and August. 1315 clearly stands out as exceptionally wet.[15] During the last month of the growing season, grain – and especially wheat – are extremely vulnerable to rain.[16] Starting in 1314, the rainy weather led to back-to-back harvest failures which resulted in a grain shortage and, subsequently, steep price increases for grain and other foodstuffs.[17] The resulting famine conditions affected not only England but also the rest of Europe; contemporary narrative sources paint a horrifying picture of these years that includes surplus rain, harvest failures, high prices, rampant hunger, inferior substitute foodstuffs, diseases, and even cannibalism.[18]

How do the matter-of-fact demesne accounts refer to these extreme weather events? The account of the agricultural year 1314/1315 disproportionately mentions rain and its consequences. Titow's compilation for this year is impressive, stretching over more than one full printed page. The accounts for this year include far more references to weather than those of any other agricultural year.[19] The examination of the relevant pipe roll, however, provides a more differentiated picture. The accounts are recorded on twenty-eight parchment membranes.[20] The account of the manor Waltham St. Lawrence, situated in Berkshire, for example, is written down on the recto and dorso side of membrane 15 (Figure 1). The name of the manor marks the beginning of the entry, which opens with the cash revenues and expenses of the manor. The revenues resulted from rent, the sale of agricultural products, and various fines, while expenses were incurred for the purchase, maintenance, and repair of ploughs, tools, carts, and buildings. This section includes additional costs and wages for animal husbandry and harvest labor. The second part of the account is a detailed overview of the different grains, animals, and products in

14 Bruce M. S. Campbell, Four Famines and a Pestilence. Harvest, Price, and Wage Variations in England, 13th to 19th centuries, in: Britt Liljewall et al. (ed.), Agrarhistoria på många sätt. 28 studier om manniskan och jorden. Festskrift till Janken Myrdal på hans 60–årsdag, Stockholm 2009, pp. 23–56, here pp. 33–35; Bruce M. S. Campbell, Nature as Historical Protagonist. Environment and Society in Pre-industrial England, in: Economic History Review 63 (2010), pp. 281–314, here p. 293.

15 Edward R. Cook et al., Old World Megadroughts and Pluvials during the Common Era, in: Science Advances 1.10 (2015), pp. 1–9.; see the maps for the relevant years in the Old World Draught Atlas (OWDA):http://kage.ldeo.columbia.edu/TRL/OWDA/ [11.09.2016].

16 Christian Pfister, Weeping in the Snow. The Second Period of Little Ice Age-Type Impacts, in: Wolfgang Behringer/ Hartmut Lehmann/ Christian Pfister (eds.), Kulturelle Konsequenzen der „Kleinen Eiszeit". Cultural Consequences of the „Little Ice Age" (Veröffentlichungen des Max-Planck-Instituts für Geschichte 212), Göttingen 2005, pp. 31–86, here pp. 62–66.

17 Philip Slavin, The 1310s Event, in: Christian Pfister / Franz Mauelshagen / Sam White (eds.), Palgrave Handbook of Climate History, London 2018, pp. 495–515.

18 Kershaw (note 4), pp. 6–8; Jordan (note 4), pp. 8–23; Philip Slavin, Ecology, Warfare and Famine in the Early Fourteenth-Century British Isles. A Small Prolegomenon to a Big Topic, in: Pere Benito Monclús/ Antonio Riera Melis (eds.), Guerra y carestía en la Europa medieval, Lleida 2014, pp. 87–102, here pp. 88–89.

19 Titow (note 6), pp. 385–386.

20 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15).

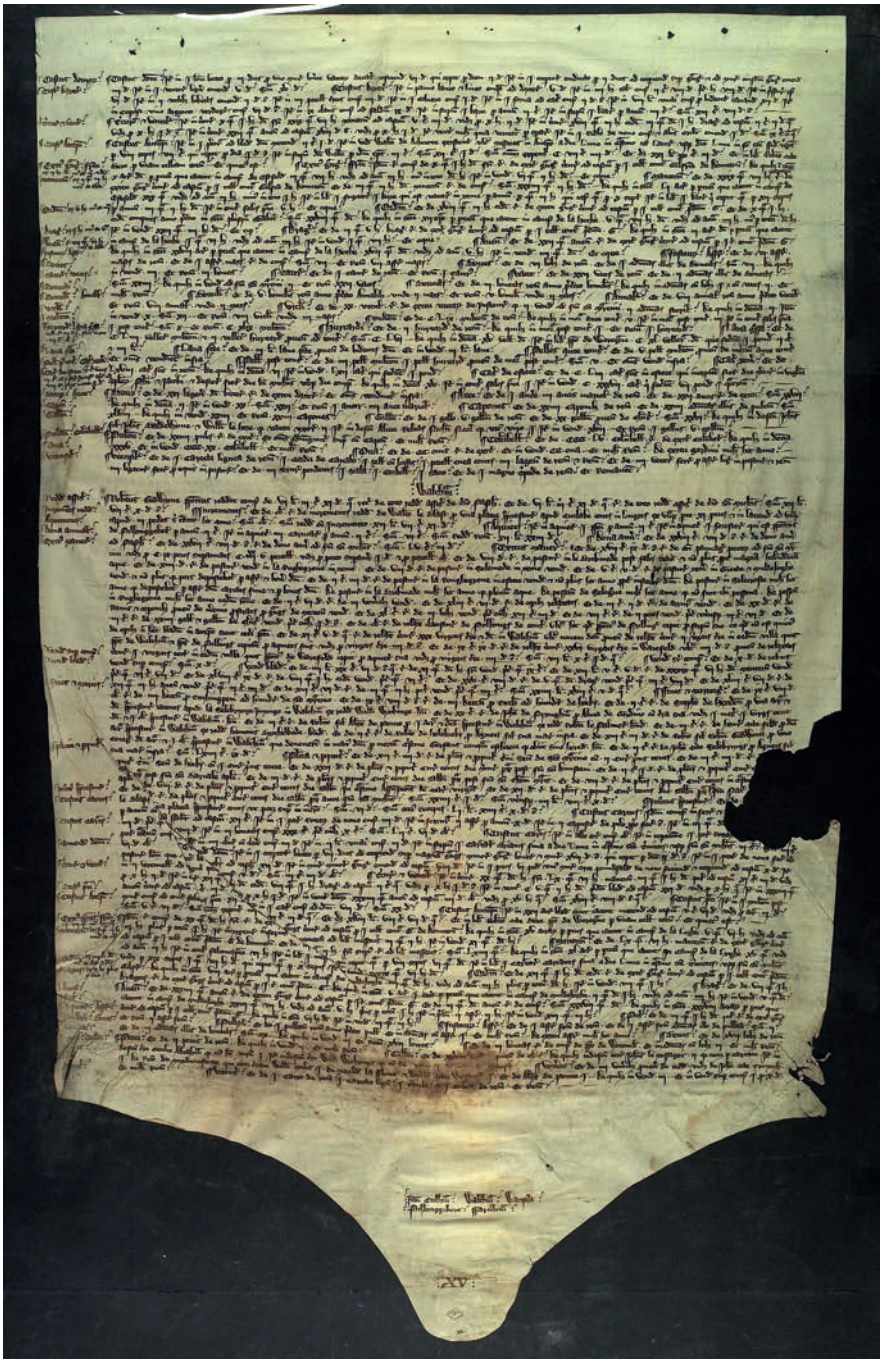

Figure 1: Account for the manor Waltham St. Lawrence in the Winchester Pipe Roll for 1314/15: Winchester, Hampshire Record Office, 11M59/B1/70, m. 15r.

stock on the manor. The account thus provides information on cash revenue, expenses, and inventory – in other words, on the overall economic situation of the manor.[21]

These different parts of the account are divided into subsections marked by distinctive bold headings in the text. Glosses in the margins of the membranes allow for a better orientation in the document. The section entitled *exitus manerii* or "issues of the manor" is the focus of the following analysis.

On the manor Waltham St. Lawrence, heavy rains and subsequent flooding made it impossible to rent out the pastures. The revenue from renting the pastures of the manor was noted in the section *exitus manerii,* which records the name of the pasture and the money received. Recurring references to rain in 1314/1315 and its consequences appear in this context: "And eight penny from the pasture in le Brokmede rented out after mowing and not more because of the heavy flooding by water."[22] Two lines further down, the entry remarks: "From the pasture in le Brokmede nothing this year, because it was full of water."[23] Apparently, rainwater had flooded the pasture, preventing its use and the collection of rent, which diminished the cash revenue of the manor. This correlation is clearly described in the account.

So far, two of the short quotes from Titow's compilation have been localized here by referencing the original document. Examining the entire pipe roll allows for an interpretation of the references to weather and its consequences in a wider context. Looking at the account as a whole reveals that weather is just one of many reasons for reduced or missing revenue. In Waltham St. Lawrence, only one of seven pastures was negatively affected by the weather impacts of 1314/1315. Revenues for some other pastures remained constant; in other cases of diminished or missing revenues, the account provided other justifications.[24] The situation is similar for the pastures on the other Winchester manors and in the agricultural years of 1313/1314 and 1316/1317. The wording of the references to the weather events and their consequences changes

21 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 15r–15d. See the account of the manor for 1301/02 in: Pipe Roll 1301–02 (note 7), pp. 185–188. For demesne accounts in the beginning of the Fourteenth century in general see Paul D. A. Harvey, Manorial Records (Archives and the User 5), London 1984, pp. 31–35.

22 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 15r (Waltham St. Lawrence): *Exitus manerii: […] Et de viii d. r. de pastura in la Brokmede post falcationem vendita et non plus propter magnam habundantiam aque.*

23 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 15r (Waltham St. Lawrence): *De pastura in la Brokmede nichil hoc anno, quia plenum [sic!] aque.*

24 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 15r (Waltham St. Lawrence): *Exitus manerii: […] Et de xiiii d. r de pastura vendita in la Inghegrove in yeme. Et de viii d. r. de pastura in Selemede in yeme vendita. Et de v s. v d. r. de pastura in Gretle et Unldelughe vendita et non plus, quia pars depastebatur per affros et boves domini. Et de ii s. iiii d. r. de pastura in la Ronghegrove in estate vendita et non plus hoc anno propter instauramentum domini. De pastura in Selecroste nichil hoc anno, quia depastabatur per affros domini cariantes fima et per boves domini.*

from because of flooding by water (*propter inundacionem aque*),[25] over because of heavy flooding by water (*propter magnam habundantiam aque*)[26] and because of extreme flooding by water (*propter maximam inundacionem aque*)[27] to because of very extreme flooding by water (*propter nimiam habudantiam aque*)[28] to indicate different degrees of flooding. Generally, just one or two pastures of a manor were affected, never all of them in a single year. In 1315/1316, only one of eleven pastures of the manor Adderburry was affected by rain.[29] Other explanations appear just as often as the weather impacts. The most common explanation for a pasture having not been rented out was that the bishop's cattle and sheep had been grazed there. As the pipe roll for 1301/1302 shows, this is the dominant explanation in years without extreme weather events, too.[30] When cattle were driven to the pastures because their usual grounds were flooded, this is clearly stated in the account. So, for example, for Pillingbere in 1314/1315: "The reeve Alexander de Ponte renders account for nineteen shillings and nine and a halfpenny from the pasture in Pillingbere and not more this year because the draught animals from the manors in Weregrave, Culham, and Waltham St. Lawrence grazed here, for their usual pastures were flooded by water."[31] From the agricultural year 1315/1316 onwards, another issue appears in the accounts: on some manors, the reeves could not find any tenants and therefore had to record missing revenue. This happened, for example, in Wittney in 1316/1317: "Nothing from the pasture behind the manor house this year, because no one wanted to rent it as there were too many pastures for rent."[32] This might be the result of an overall price increase during the famine years that required the re-allocation of money which had been used to rent pastures.

It is remarkable that these sections about rent for pastures include very nearly all the references to weather conditions and their consequences in regards to income. The only exception is a reference to peat production in Downtown, where there was no revenue from peat in 1315/1316.[33] Surprisingly, the sections on the sale and inventory of grain do not mention weather impacts at all, even though extreme weather

25 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 11d (Adderburry).
26 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 13d (Morton).
27 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 4d (Downton).
28 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 15d (Pillingbere).
29 Winchester, Hampshire Record Office, 11M59/B1/71 (1315/16), m. 17r (Adderburry): *Exitus manerii: [...] De pastura in Muchelham nichil hoc anno propter inundancionem aque.*
30 Pipe Roll 1301–2 (note 7), pp. 218–219 (Bentley), p. 261 (Droxford), p. 312 (Cheriton), p. 322 (Alresford).
31 Winchester, Hampshire Record Office, 11M59/B1/70 (1314/15), m. 15d (Pillingbere): *Exitus manerii: Alexander de Ponte prepositus reddit computum de xix s. ix d. ob. r. de pastura de Pillingbere vendita et non plus hoc anno, quia averia maneriorum de Weregrave, Culham et Waltham [St. Lawrence] depastebantur in eadem pastura propter nimiam habundantionem aque existentem in pasturis dictorum maneriorum.*
32 Winchester, Hampshire Record Office, 11M59/B1/72 (1316/17), m. 11r (Wittney): *Exitus manerii: [...] De pastura retro curiam nichil hoc anno, quia nullus eam locare voluit propter habundaciam pasture in patria.*
33 Winchester, Hampshire Record Office, 11M59/B1/71 (1315/16), m. 7d (Downton): *Exitus manerii: [...] De turbis nichil hoc anno pro tempore pluvioso.*

events could devastate grain production. Titow calculated yields of thirty-six percent below average for 1314/1315 and forty-five percent below average for 1315/1316.[34] Nevertheless, no explanation was necessary in this case, considering the circumstances in which these accounts were compiled: at the end of the agricultural year, the reeves answered personally to the bishop's administration about the revenues of the last year. After the account had been reviewed and audited as deemed necessary, the details were recorded in the pipe roll. As all the parties involved were aware, grain yields were extremely volatile depending on a variety of factors. If enduring rainfall during the previous summer had negatively impacted the grain harvest, there was apparently no need for detailed explanations. The general weather conditions of the previous months would have been common knowledge among the reeves and the officials of the episcopal administration. Rising grain prices were an important consequence of these events.[35] As a result, large-scale producers like the bishop of Winchester profited enormously from such developments and had little reason to mention the weather or complain about it.

The income side of the demesne accounts thus generally mentions weather and its consequences only in the context of explaining reduced or missing revenues from pasture leases. The episcopal administration held certain, fixed expectations for this element of the manor's income, and the reeve was responsible for providing detailed information for any deviation from these expectations.

This close control over the pasture leases is a product of the historical development of the direct management of the bishop's estates dating back to the twelfth and thirteenth century: unlike their counterparts in continental Europe, landowners in England stopped renting out their lands to tenants; bishops, cathedral chapters, lay magnates, and later the king himself were driven by the fear of inflation and alienation of the property to abolish the long-term lease of land to individual tenants. On the one hand, this measure aimed to prevent financial losses due to currency devaluation – an imminent danger when long-term leases fixed rents. On the other hand, landowners' growing difficulties to prove ownership in the developing English judicial system made the alienation of the property a real danger, as well, in cases where a tenant's family had held a manor for generations. As a result, the owners started to manage the cultivation their land themselves in a system of direct management that took advantage of the labor service obligations owed them. Peasants had to work on their lord's estates and the resulting harvest was sold on the local market. In addition, smaller parcels of land were rented out with short-term contracts to prevent competing claims to the property rights.[36] From this point onwards, unfree peasants

34 Titow (note 6), pp. 385–386.

35 Ibid., p. 386.

36 Paul D. A. Harvey, The Pipe Rolls and the Adoption of Demesne Farming in England, in: Economic History Review 27 (1974), pp. 345–359; Edward Miller/ John Hatcher, Medieval England. Rural Society and Economic Change 1086–1358, London, New York 1978, pp. 204–224; Robert C. Stacey, Politics,

produced agricultural goods on the Winchester manors under the close control of the bishop's administration. As the first link in the chain of command in this system, the reeves were responsible for the single manors and had to explain what had happened on their manors during the agricultural year to the episcopal administration, which recorded these accounts in the pipe roll. In this context it is understandable that the accounts on pasture leases required more explanations than other parts of the manor's production. The central administration in Winchester was seemingly concerned about the potential for losses and alienation associated with the independent leasing out of the pastures organized by the reeves. As a result, they expressed precise expectations for the rent income from the pastures and expected the reeve to meet these expectations or justify his failure to do so. The account of the manor in Esher for the year 1320/1321, for example, in a report of lacking revenue, clearly states the expectation that the pasture in question should incur an income of six pennies.[37] If it was not possible to meet the administration's expectations, the reeve had to offer an appropriate and convincing justification. Adverse weather conditions and their consequences were possible justifications, which explains the references to weather in the Winchester Pipe Rolls. This also raises the question as to the reliability of this historical weather data: although its acceptance can be read as a certain contemporary acceptance of the account as feasible, these accounts were ultimately part of an argument in the seigniorial discourse described above. Paul Harvey rightly advised caution for the analysis of demesne accounts in general: "The purpose of manorial accounting was to establish the state of reckoning between lord and local official: we should never take for granted that it records what really happened on the manor."[38] This caution should be kept in mind when looking at the references to weather in the Winchester Pipe Rolls.

This is not to say that the references to weather and its consequences in the Winchester Pipe Rolls were not based on the observation of actual environmental impacts. These references, however, served as an argument during the rendering of the account, and they were noted almost exclusively in one section of the pipe roll. This should be kept in mind when using these sources to reconstruct past weather events. Even seemingly matter-of-fact accounts are characterized by narrative and communicative patterns that require analysis. The relationship between lord and subjects is an important factor to consider. References to weather and its consequences only exist in accounts of those manors that were managed directly by the lord – e.g., the estates of the cathedral chapter of Norwich in East England or of Battle Abbey in

Policy and Finance under Henry III, 1216–45, Oxford 1987, pp. 66–92; Vincent (note 8); Jörg Peltzer, The Slow Death of the Angevin Empire, in: Historical Research 81 (2008), pp. 553–583, here p. 568.

37 Winchester, Hampshire Record Office, 11M59/B1/76 (1320/21), m. 18r (Esher): *Exitus manerii: [...] De pastura in la Fitch, que solebat vendi pro vi d., [...] nichil hoc anno, quia nulli venerunt emptores causa morine bestiarum.*

38 Harvey (note 21), p. 34.

South England.[39] The accounts of estates that were not managed directly, but rather leased out – e.g., the manors of Bolton Priory in the north of England – do not refer to the weather at all – even in the extreme years from 1315 to 1317.[40] This highlights just how important the seigniorial, social, and economic circumstances were in the creation of these documents. In the end, they give us mainly insights into these circumstances, but hardly any information on the influence of the weather impacts on the living conditions of the people living and toiling on the bishop's land, that were severely hit during the famine years.

3 The Narrative Sources

The second part of this contribution discusses the narrative patterns of environmental impacts in two historiographical accounts of the famine years: a chronicle composed allegedly by the monk John of Trokelowe and the *Vita Edwardi Secundi*, written by an anonymous secular cleric.[41] Although both texts mention the famine, their focus is clearly on contemporary politics and events such as Edward II's wars against Scotland and Wales and the barons' opposition to the king. The authors are accordingly less interested in the weather events themselves than in the social consequences of inclement conditions.

The author of the *Annales*, presumably St Albans *frater* John of Trokelowe, offers a nearly contemporary account of the famine years in this work, which dates to the 1330s.[42] Although Trokelowe sympathizes with the baronial opposition against Edward II, he also describes the king far more favorably than any other contemporary chronicle. The tradition of close ties between the monastery of St Albans and the monarch might explain that benevolence.[43] For the year 1315, Trokelowe describes long rainy periods that started in May and lasted until the beginning of September. The text states that the continuous rainfall and lack of sunshine prevented the grain

39 Herbert E. Hallam, The Climate of Eastern England 1250–1350, in: Agrarian History Review 31 (1984), pp. 124–132; Peter F. Brandon, Late-Medieval Weather in Sussex and Its Agricultural Significance, in: Transactions of the Institute of British Geographers 54 (1971), pp. 1–17.

40 The Bolton Priory Computus, 1286–1325, ed. Ian Kershaw/ David M. Smith (The Yorkshire Archeological Society. Record Series 154), Woodbridge 2000.

41 Antonia Grandsen, Historical Writing in England. Vol. 2: c. 1307 to the Early Sixteenth Century, London, Henley 1982, pp. 4–8, 31–37; Julia Marvin, Cannibalism as an Aspect of Famine in Two English Chronicles, in: Martha Carlin/ Joel T. Rosenthal (eds.): Food and Eating in Medieval Society. London 1998, pp. 73–86.

42 Brian Murdoch, Art. John of Trokelow, in: The Encyclopedia of the Medieval Chronicle, vol. 2, Boston 2010, p. 339.

43 Grandsen (note 41), pp. 5–7.

from growing and maturing over the summer.[44] The little grain that was harvested had become so wet it had to be dried in ovens. Only then was it possible to process it further and to bake bread. The resulting bread, however, lacked the usual nutritional value, for the sun had not been able to put its strength in the grain; even large amounts of the bread, therefore, left the people eating it hungry.[45]

The monk precisely describes the close correlation between lack of sunshine, abundant rain, harvest failure, and bread quality. In an agricultural society, this was common knowledge shared by everyone, including the educated elite. Trokelowe's account of the weather events is factual, lacking any metaphysical dimension. The rainfall is seen as a weather phenomenon and not as divine punishment. He does not interpret weather as having been caused by an external power but simply describes its immediate consequences for the agrarian production.

The social consequences of the harvest failures, however, are judged on a moral level. Criticizing the high prices for food, Trokelowe condemns the rich, the thieves, and all others who act unfairly and unlawfully during the ensuing crisis. He is especially critical of lay and ecclesiastical princes who had curtailed their almsgiving or dissolved their courts, which forced former servants to beg, rob, and steal, and ultimately fomented crime and social unrest in the broader society, as well.[46] In the end, this narrative alludes to a link between the famine conditions, the king's wars, and an Old Testament prophecy (Jeremiah 14:18) which describes a vision of "the ravages of famine" among city dwellers and "those slain by the sword" in the country.[47] This is the only explicit biblical reference in Trokelowe's account of the famine years.

---

44 Johannes de Trokelowe, Annales, in: Chronica et annales regnantibus Henrico tertio, Edwardo primo, Edwardo secundo, Ricardo secundo, et Henrico quarto. A. D. 1259–1296; 1307–1324; 1392–1406, ed. Henry Thomas Riley (Rerum britannicarum medii aevi scriptores 28, 3). London 1866, pp. 63–127, here p. 93: *Dicta quidem caristia mense Maio, anno Domini millesimo trecentesimo quinto-decimo, incepit, et usque ad festum Nativitatis Beatae Mariae* [8. September] *duravit. Pluviae enim aestivales in tantum abundabant, quod fruges maturescere non poterant.*

45 Ibid., p. 93: *Sed vix ad dictam diem Nativitatis pro pane coquendo colligi poterant, nisi prius ad desiccandum in clibanos mitterentur. Versus finem autumni, ipsa caristia in parte fuerat mitigata, sed circa festum Natalis Domini totaliter redibat. Nec habebat panis robur nutritivum, seu virtutem substantialem more solito in se, pro eo quod grana a calore solis aestivi nutrimentum non habebant. Unde comedentes ex eo, licet magnum exinde sumerent quantitatem, brevi elapso intervallo famelici remanebant.*

46 Ibid., p. 93: *Nec est abigendum, quin paupers fame et inedia contabescerent, si divites post refectiones opulentas continuo esurirent. Hiuismodi igitur fame prevalente, tam magnates quam religiosi curias suas restringebant, solitas eleemosynas subtrahebant, familias suas minuebant. Unde illi a curia sic amoti, vitam delicatam ducere consueti, fodere nesciebant, mendicare erubescebant, peniuria tamen cibi et potus devicti bona aliena sitiebant, caedibus et rapinis intendentes. Tot autem effecti sunt infidels, quod in pace vivere non permiserunt fideles.*

47 Ibid., pp. 93–94: *Angustiis igitur et miseriis praemissis et futuris consideratis et intellectis, illud propheticum quod in in Jeremia dicitur, "Si egressus fuero ad agros, ecce! occisi gladio; et si intruiero in civitatem, ecce! attentuati fame" in populo Anglicano adimpleri his diebus cernere poterimus, ad egredientes, cum ruinam gentis nostrae in Scotia et Vasconia, Wallia et Hibernia, diversis temporibus*

In his account of 1316, Trokelowe highlights the economic consequences of the enduring rain, especially on the soaring prices for grain and salt, which both had risen to thirty shillings in June and to forty shillings by August.[48] To underline the intensity of the famine conditions, Trokelowe describes how the population resorted to drastic coping strategies such as eating horse and dog meat. Furthermore, he quotes rumors of cannibalism.[49] Even the king's court had allegedly struggled to buy enough bread while staying at St Albans.[50] The famine affected all strata of society. In an interesting paragraph, Trokelowe explains that the main reason for the rising death toll in England was not malnutrition itself but infectious diseases.[51] This corresponds with modern insights into famine mortality. In this context, weather impacts are once again of importance: according to the *Annales*, physicians could not prepare effective medicine to treat and inhibit the spreading diseases because the unfavorable weather conditions destroyed the herbs usually used for this purpose.[52]

The monk of St Albans gives a clear and precise account of the weather events. In the narrative of the *Annales*, weather is a natural phenomenon, which, combined with other economic and political factors, leads to severe famine conditions. The text focuses on the social consequences of the hunger crisis and discusses the famine's moral and metaphysical dimensions rather than clearly describing the weather events themselves.

The *Vita Edwardi Secundi* offers an entirely different perception and interpretation of the extreme weather events. Probably written during the same period by an

factam, una cum hiis qui per insidias latronum de die in diem jugulati sunt, ad mentem reducimus. Attentuatosautem fame perpendimus civitatem introeuntes, cum pauperes et egenos, ipsa fame oppressos, per vicos et itinera squalentes et mortuos jacere conspicimus.

48 Johannes de Trokelowe (note 44), p. 94: *[…] et ipso parliament durante, crevit fames vehementer. Summa enim frumenti et etiam salis pro triginta solidis usque ad festum Sancti Johannis Baptistae [24 June] vendebatur; a quo quidem die usque ad festum Assumptionis Sanctae Mariae [15 August] ad quadraginta solidos ascendebat.*

49 Ibid., p. 95: *Ut posteris liqueat, quanta duritia vivendi per Angliam tunc erat, pauca, priusquam mandatum regium exprimatur, huic scripto duxi inserere. Quatuor autem denariatus de grosso pane non sufficiebant uni simpli homini in die. Carnes quidem communes, et ad vescendum licitae, strictae erant nimis; sed carnes equinae pretiosae eis fuerant, qui canes pingues furabantur; et, ut multi asserebant, tam viri quam mulieres parvulos suos, et etiam alienos, in multis locis furtim comedebant. Sed, quod horribile est ad futororum notitiam perducere, incarcerate etiam fures inter eos recenter venientes in momento semivivos devorabant.*

50 Ibid., p. 92: *Unde terra tanta penuria premebatur, quod, cum Rex apud Sanctum Albanum in festo Sancti Laurentii* [10. August] *proximo sequente declinaret, vix poterat panis venalis, pro suae specialis familiae sustentatione, inveniri.*

51 Ibid., p. 94: *Ipsa igitur fame totam terram sic opprimente, mortalitas hominum subsecuta est. Tot moriuntur egeni, quod vix sufficient vivi ad sepulturam mortuorum. Morbus enim dysentericus, ex corruptis cibis conceptus, ferre omnes maculavit; quem sequebatur actua febris, vel pestis gutturuosa.*

52 Ibid., p. 94: *Nec potuit in hac pestilentia contra praedictos morbos prudentia physicorum, prout antiquitus solebat, aliquod congruum in arte sua reperire remedium. Herbae enim medicinales, quae mortalitatistempore levamen languidis solebant confere, propter aeris intemperiem, et inordinatam elementorum collisionem, contra suam naturam degeneratae, virtus pro virtute reddebant.*

anonymous secular clergyman, the *Vita* is not a traditional chronicle but an elaborate literary work full of biblical, canonical, and historical references.[53] The narrative concentrates on the political events of Edward's reign. It views the king's character und his actions critically, and the author's support of the baronial opposition is apparent. Nevertheless, Edward remains the center of the English kingdom, and the text does not fundamentally challenge his position. The author's different, sometimes contradictory, perspectives on the king and his reign can be explained by the successive writing of the four parts of the *Vita* in 1313, 1315, 1318 and 1320.[54] Unlike in John of Trokelowe's account, the description of the famine years here is dominated by contemporary political developments, especially the war against the Scots, the rebellion of Llywelyn Bren in Wales, unrest at Bristol, and the convocation in October 1316.[55]

The extreme weather events and their consequences are dealt with in three rather short paragraphs. For 1315, the author stresses the divine origin of the rain, which he interprets as punishment for the arrogance and wickedness of the English people. The overabundance of rain is referred to in a summary description highlighting the detrimental effects on grain and animals. Like Trokelowe, the author of the *Vita* links the resulting harvest to a vision of the prophet Isaiah, in which ten acres of vineyard yield only a handful of grapes, and thirty bushels of seed yield only three bushels at the harvest (Isaiah 5:10).[56] The *Vita* integrates the weather events into a metaphysical interpretation of various problems confronting the English people. A detailed description of the rain is therefore unnecessary; the short characterization as a horrible act of God suffices. The paragraph ends with the author's doubts concerning the willingness of his countrymen to change their actions and habits and his fear of further calamities. In the narrative of the *Vita*, only the prayers of the English Church prevented the kingdom's downfall.[57]

---

53 Vita Edwardi Secundi. The Life of Edward the Second. Re-edited Text with New Introduction, New Historical Notes, and Revised Translation Based on that of N. Denholm-Young by Wendy Childs, Oxford 2005, pp. xix–xxxii; Chris GIVEN-WILSON, Vita Edwardi Secundi. Memoir or Journal?, in: Thirteenth Century England 6 (1997), pp. 165–176; Susan Foran, Art. Vita Edwardi Secundi, in: The Encyclopedia of the Medieval Chronicle, vol. 2, Boston 2010, pp. 1487–1488.

54 Wendy R. Childs, Resistance and treason in the Vita Edwardi Secundi, in: Thirteenth Century England 6 (1997), pp. 177–191, here pp. 177–179; Given-Wilson (note 52), p. 168.

55 Given-Wilson (note 53), p. 168.

56 Vita Edwardi Secundi (note 53), p. 110: *Per alia quedam signa apparet manus Dei contra nos extenta. Nam anno preterito tanta fuit habundancia pluuie quod uix licuit hominibus frumenta colligere uel horreo salua recondere. Anno uero presenti deterius euenit. Nam inundacio pluuiarum omne fere semen consumpsit, in tantum ut uaticinium Ysaye iam uideretur expletum esse; ait enim decem iugera uinearum faciunt lagunculam unam, et triginta modii sementis faciunt modios tres; et in pluribusque locis fenum tam diu sub aquis latuit quod nec falcari nec colligi potuit. Oues autem communiter perierunt et alia animalia subita peste ceciderunt.*

57 Ibid., pp. 110–112: *Ualde autem nobis timendum est ne, si Dominus post hec flagella incorribiles nos inuenniat, homines et pecora simul disperdat; et constanter credo quod, nisi intercederet Anglicana religio, dispersi fuissemus elapso tempore multo.*

For the year 1316, the *Vita* highlights the economic and social consequences of the extremely rainy weather and describes the famine as the severest natural disaster to impact English society in a century.[58] This stark picture stands in sharp contrast to the small amount of attention the text devotes to this event, however. The *Vita* paints a hopeless image of the situation, which includes the symbolic high price of forty shillings per bushel of wheat in London and thirty shillings in the rest of the kingdom, as well as remarks on the connection of hunger, diseases, and death.[59] Furthermore, the author reports on unclean substitute food such as dog and horse meat being eaten in the far north of England, where frequent Scottish raids presented an additional challenge for the population.[60] After once again criticizing the morals of the English people, the *Vita* provides an alternative "scientific" explanation for the extreme weather events; it refers to learned experts who provide an astrological-meteorological explanation based on the negative effects of Saturn as the cause of the detrimental weather. As planets continue in their course, these experts propose, Saturn will be followed by Jupiter, bringing far more favorable weather and restoring the usual conditions.[61] The author is familiar with astrological ideas popular at the University of Oxford at this time[62] and uses this natural cause as a narrative counterpoint to his metaphysical interpretation of the events. In the framework of medieval astrology, this was not a contradictory but rather a complementary explanation: in this interpretation, God influenced the weather through the stars, which followed the rules of natural physics.[63]

For the year 1318, the last paragraph mentioning the famine deals with the end of the extreme weather events and the return to the usual order. In combination with the end of the wars in Scotland and Ireland and with Edward's reconciliation with the

58 Vita Edwardi Secundi (note 53), p. 120: *Transeunte solempnitate Paschali cepit caristia bladi uehementer augeri. Non est uisa temporibus nostris in Anglia nec audita centum <annis> retroactis tanta caristia.*

59 Ibid., p. 120: *Nam Londoniis et locis uicinis uendebatur modius triciti pro quadraginta denariis, et in aliis partibus terre ubi minor erat concursus hominum triginta denarii erat commune precium. Porro durante peniuria creuit et fames ualida et post famem dura pestelencia, ex qua moriuntur in diuersis locis plus quam milia.*

60 Ibid., p. 120: *A quibusdam eciam audiui relatum, quod in partibus Northumbrorum canes et equi et alia immunda sumebantur ad esum. Hii enim propter frequentes incursus Scotorum maiori tedio laborant, quos maledicti Scoti suis uictualibus cotidie spoliabant.*

61 Ibid., p. 122: *Dicunt tamen sapientes astrologie has celi tempestates naturaliter euenisse; Saturnus enim securus et frigidus asperitates procreat inutiles seminibus; triennio iam regnans cursum consummauit, et sibi mitis Jubiter ordine successit. Porro Joue regnante cessabunt pluuiales unde, ualles habundabunt frumento et campi replebuntur ubertate.*

62 Hilary M. Carey, Courting Disaster. Astrology at the English Court and the University in the Later Middle Ages, Basingstoke, London 1992, pp. 55–56, 58–78.

63 Gerrit Jasper Schenk, *Disastro*, Catastrophe, and Divine Judgement. Words, Concepts and Images for 'Natural' Threats to Social Order in the Middle Ages and Renaissance, in: Jennifer Spinks/ Charles Zika (eds.), Disaster, Death and the Emotions in the Shadow of the Apocalypse, 1400–1700, Basingstoke 2016, pp. 45–67, here p. 49.

barons, this is interpreted as the beginning of a promising future for England and its people.[64] References to the Bible are made here, too: the events of the famine are compared to description of the siege of Samaria in the Old Testament (2 Kings 6). During this siege, a steep price rise occurred and the inhabitants of the city resorted to cannibalism. After the city was liberated with the help of God, prices returned to normal levels, and social order was restored in Samaria.[65] A similar course of events took place in the English kingdom of the fourteenth century, according to the *Vita*. Juxtaposing these medieval weather events and their economic and social consequences with a biblical episode embeds them in a wider typological and eschatological framework.[66] Unlike Trokelowe's account, the anonymous work makes no direct reference to cannibalism in England during the famine years, but the allusion to the events during the siege of Samaria might hint at the idea that cannibalism also occurred in fourteenth-century England, even if the author only cautiously implies this.

The *Vita Edwardi Secundi* uses weather as part of a metaphysical interpretation of the political events in England at the beginning of the fourteenth century. Weather and its consequences transpired on the same level as other events of the time, including wars, civil unrest, and baronial opposition. Since weather impacts are not conceptualized as events of a different magnitude, their descriptions are not very detailed or elaborated. In the narrative of the work, they are simply yet another scourge facing English society.

4 Conclusion

The sources discussed here record a variety of references to the weather from diverse contexts; there are a number of speakers and motivations for these records. While the reeves of the Winchester manors used weather to explain diminished revenues in specific sections of the agricultural account, the authors of the narrative sources followed a different path. John of Trokelowe concisely describes the weather events as natural phenomena without any metaphysical dimension. He judges the human reactions and their economic and social consequences at a moral level. The *Vita Edwardi Secundi*, on the other hand, includes weather in a portfolio of divine punishments directed at English society. The details of the weather events themselves are

64 Vita Edwardi Secundi (note 53), pp. 154–156.

65 Ibid., pp. 154–156: *<Tercio cessauit> sterilitas illa que diu nos afflixit, et habundancia omnium bonorum terram Anglorum multipliciter fecundauit. Modius tritici, qui anno preterito pro quadraginta denariis uendebatur, hodie pro sex denariis emptori libenter offertur. Sic olim tamdiu obsessa Samario, ut mater uesceretur pro penuria uictualium, recuperauit diuina gracia. Nam capud asini, quod octoginta aureis pridie uendebatur, omnibus inmundum in crastino reputatum erat, et modius simile pro statere uno uenundatus, sicut perdixerat uir Dei Heliseus.*

66 Marvin (note 41), p. 78.

less important in this context than the harshness of the resulting conditions for the English people.

Any examination of the intertwinement of environment and society in the fourteenth century must being with the careful analysis of references to natural events in the sources. The context in which these sources were created is essential to avoiding problems which they could pose for historical research. By analyzing the communicative setting and the narrative patterns of accounts and historiography, historians can reach other insights than they can, for example, by concentrating on the reconstruction of grain yields or the fourteenth-century weather conditions. The questions formulated in the introduction are important when interpreting references to natural impacts in historical sources. Only after the texts referring to weather events and the context of their creation have been critically assessed, it is possible to address broader questions of societal reactions to environmental impacts in a meaningful way. To achieve this, environmental historians must base their research on detailed analysis of the perceptions of the environment in the sources examined. This is the first step towards writing a definitive environmental history of fourteenth-century England.

András Vadas

The Little Ice Age and the Hungarian Kingdom? Sources and Research Perspectives

Abstract: The paper surveys the possibilities and limitations of identifying the impacts of the Little Ice Age (LIA) in the Kingdom of Hungary in the late medieval period. Using a variety of written sources, scholars working on western and other parts of central Europe have documented weather events and environmental processes associated with the LIA. Despite the scarcity of some of these genres of written evidence – notably narrative sources – for historians working in the Hungarian region, there are indications of similar, if less pronounced, contemporary phenomena in the Kingdom of Hungary, which covered most of the Carpathian Basin in the late medieval period. This paper discusses two case studies, beginning with the problem of the appearance of the so-called "Great Famine" of 1310s in this area. Despite the lack of contemporary domestic narrative accounts of the events, legal evidence and other sources suggest that some aspects of this weather-related crisis had a similar effect on the Hungarian kingdom as on other parts of central Europe (Bohemia, Poland, and the German lands). These sources, however, mention virtually nothing on the extent of the famines – they may have been only local or regional problems. The second part of the paper discusses the research potential into the long-term impacts of the Little Ice Age; while information on the climatic processes is limited, a clear shift in the water table resulted in changes in the suitability of certain altitudes and areas for settlement in the late medieval period.

Keywords: Little Ice Age, climate history, environmental history, famines, Kingdom of Hungary

Note: The research was supported by the Eötvös Loránd University Higher Education Institutional Excellence Program of the Ministry of Human Capacities (1783-3/2018/FEKUTSTRAT). The study was written in 2016, in the case of works published since then only some bibliographic indications are included. Modern place names are used throughout the article. However, I will refer in the article to the whole area of the medieval Hungarian kingdom which mostly included modern Hungary, Slovakia, and western Romania.

Dr. András Vadas, assistant professor, Eötvös Loránd University, Institute of History, Department of Medieval European History, Múzeum krt. 6-8 I/136, H-1083 Budapest
vadas.andras@btk.elte.hu

Open Access. © 2020 András Vadas, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-013

1 Introduction

The paper explores to what extent the climatic processes scholars have documented for western Europe can be confirmed using similar research methods in the Hungarian kingdom, which covered most of the Carpathian Basin in the Middle Ages. The title asks a legitimate question, for the sources to which medieval historians working on this area of east central Europe have access are somewhat different from those to which historians working on France or Switzerland are accustomed. While it is not yet clear which, if any, consequences the Little Ice Age (LIA) had in Hungary, there is preliminary evidence of weather patterns and climatic processes similar to those which have been demonstrated for western and central Europe in the late medieval period, even if a scarcity of source material for the study of the Carpathian Basin is more of a problem than in other regions of Europe.

This study begins with a consideration of the 1310s, a decade usually considered the first uncharacteristically cold and wet decade of the fourteenth century and the beginning of the LIA. The aim in this case is to argue that, despite the very scarce written evidence, some elements of the environmental crisis that were unfolding in other regions of the continent and on the British Isles or other parts of northwestern Europe reached the Hungarian kingdom as well. The study also asks to what extent long-term processes, such as changes in the hydrological regimes of various bodies of water throughout central Europe, were characteristic of the Carpathian Basin.

2 Sources and Research Situation in Hungary

Data gathered from historical sources now permits medium- and long-term climate reconstructions for the past millennium (and even longer in some places) for some parts of western and central Europe.[1] Nothing similar is possible for the medieval climate of the Carpathian Basin. After the Roman era, literacy only reappears in the region during the period of Hungarian state formation around the turn of the tenth century; the scarce legal evidence produced at that time is insufficient for climate history research. The number of legal documents produced grew significantly only from the late thirteenth century onwards, and, even then, these documents rarely mention weather-related phenomena and do not provide enough data for continuous climatic reconstruction. Whereas scholars working on western European climate

1 E.g. Rüdiger Glaser, Klimageschichte Mitteleuropas. 1000 Jahre Wetter, Klima, Katastrophen, Darmstadt 2001 and Marina V. Shabalova/ Aryan F. V. van Engelen, Evaluation of a Reconstruction of Winter and Summer Temperatures in the Low Countries, AD 764–1998, in: Climatic Change 58 (2003), pp. 219–242. On research possibilities: Rudolf Brázdil et al., Medieval Documentary Sources and their Use for Historical Climatology, in: Climatic Change (in preparation).

reconstructions have access to an abundance of chronicles and annals dating back into the Middle Ages, such sources are rather scarce for the Kingdom of Hungary until the sixteenth century. The narrative texts, as well as other written evidence mostly tell of extreme weather events and crisis periods which generated richer narrative sources.[2]

Although the 1310s are not particularly rich in contemporary domestic narratives, a critical evaluation of the domestic and foreign chronicles and annals – both contemporary and later accounts – along with legal sources (charters) allow some insight into the environmental circumstances of this period in the Carpathian Basin, as well.

Most of the weather-related events on which these written sources report are of hydrometeorological nature: floods, waterlogged lands, droughts, etc. Though research into historic floods has greater potential for the early modern period,[3] it is nonetheless possible to determine to some extent the nature and frequency of late medieval flooding of major rivers, too, especially the Danube and the Tisza.[4] In addition, studies of some bodies of standing water are promising for determining weather conditions in certain periods. The shallowness of lakes in the Carpathian Basin (especially that of Lake Fertő) means that even smaller changes in water levels caused some areas to dry out or, conversely, to become inundated. It is possible to deduce primary trends in the water levels – or changes in the extremes – in some rivers and bodies of water, but these only allow for indirect extrapolation of changes in precipitation

2 For the most recent overview of the role of written evidence in historical climatology, see: Andrea Kiss, Historical Climatology in Hungary: Role of Documentary Evidence in the Study of Past Climates and Hydrometeorological Extremes, in: Időjárás 113 (2009), pp. 315–339. For the possibilities of research into medieval weather events, see: Ead., Weather and Weather-Related Environmental Phenomena Including Natural Hazards in Medieval Hungary I: Documentary Evidence on the 11th and 12th Centuries, in: Medium Aevum Quotidianum 66 (2013), pp. 5–37; Ead., Weather and Weather-Related Natural Hazards in Medieval Hungary II: Documentary evidence from the 13th Century, in: Medium Aevum Quotidianum 68 (2014), pp. 5–46.

3 András Vadas, Floods in the Hungarian Kingdom as Reflected in Private Letters (1541–1650) – Sources and Possibilities, in: Toader Nicoara (ed.), Anuarul Scolii Doctorale. Istorie. Civilizaţie. Cultură V [Annual of the Doctoral School: History, Civilization, Culture], Cluj-Napoca 2011, pp. 77–101; Id., The "waters leave their beds frequently" – A Western-Hungarian town and the flooding of the Rába/Raab River in the Seventeenth century (1600–1659), in: Water History 5 (2013), pp. 267–286; Andrea Kiss/ Zoltán Sümeghy/ Zoltán Zsolt Fehér, A Maros 18. századi áradásai és egy jellemző téli árvizének területi hatásai [18th-Century Floods of the River Maros and the Territorial Impacts of One of Its Typical Winter Floods], in: György Füleky (ed.), A táj változásai a Kárpát-medencében. Az erdélyi táj változásai [Landscape Changes of the Carpathian Basin: Changes in the Transylvanian landscape], Gödöllő 2008, pp. 94–100; Andrea Kiss, "Suburbia autem maxima in parte videntur esse deleta" – Danube Icefloods and the Pitfalls of Urban Planning: Pest and its Suburbs in 1768–1799, in: Csaba Kovács (ed.), From Villages to Cyberspace, Szeged 2007, pp. 271–282 and Ead., "Nam per saepissimas inundationes Danubii maior pars periit", in: Chronica 12 (2016), pp. 156–167.

4 See Andrea Kiss's groundbreaking dissertation on the topic: Floods and Long-Term Water-Level Changes in Medieval Hungary, Budapest, Szeged 2011 and her forthcoming monograph: Floods and Long-Term Water-Level Changes in Medieval Hungary (Springer Water), Cham 2019.

within the catchment areas.[5] Such research, however, always incurs the constant methodological problem of how to account for the human impacts on the different water bodies. Nonetheless, the study of areas with a dense network of waterways has considerable, as yet partly untapped, potential for the study of medieval and early modern environmental (and climatic) conditions. Despite the relatively wide scope of written sources from the fourteenth century, it is not possible to determine short- or long-term climatic tendencies in the Middle Ages; this only changes with the source situation of the sixteenth or rather seventeenth century, when the number of written sources increased and, even more importantly, new types of sources appeared or became more widespread, including private correspondence, diaries, town books, account books.[6]

Over the past two decades or so, scientists have made significant advances in our understanding of medieval climate fluctuations. Dendroclimatological, paleobotanical, and complex environmental methods (e.g., pollen, macrofossil, and sediment analysis) now make it possible to reconstruct historical temperature (and precipitation) fluctuations in the Carpathian Basin.[7] However the territorial validity of the this research is relatively limited, and the high resolution studies either do not go

5 On Lake Fertő: Andrea Kiss, Changing Environmental Conditions and the Water level of Lake Fertő (Neusiedlersee) before the Drainage Works (13th–18th centuries), in: Annual of Medieval Studies at CEU 1997–1998, pp. 241–248; Ead./ Ferenc Piti, A fertői fok [The 'fok' of Fertő], in: Soproni Szemle 59 (2005), pp. 164–184. For a comprehensive overview of the literature on the changes in the level of Lake Balaton, see: Tamás Vajda, Adatok és észrevételek a Balaton 3–15. század közötti vízállásához [Data and Notes on the 3rd–15th-Century Water-Level Changes of the Lake Balaton], in: Belvedere Meridionale 26/3 (2014), pp. 49–62. On the Danube and Lake Balaton, see: Orsolya Mészáros/ Gábor Serlegi, The Impact of Environmental Change on Medieval Settlement Structure in Transdanubia, in: Acta Archaeologica Academiae Scientiarum Hungaricae 62 (2011), pp. 199–219; Andrea Kiss/ József Laszlovszky, 14th–16th-Century Danube Floods and Long-Term Water-Level Changes in Archaeological and Sedimentary Evidence in The Western and Central Carpathian Basin: an Overview with Documentary Comparison, in: Journal of Environmental Geography 6/3–4 (2013), pp. 1–11; András Vadas, Long-Term Perspectives on River Floods. The Dominican Nunnery on Margaret Island (Budapest) and the Danube River, in: Interdisciplinaria Archaeologica 4/1 (2013), pp. 73–82 and on the Great Hungarian Plain: Id., Late Medieval Environmental Changes of the Southern Great Hungarian Plain – A Case Study, in: Annual of the Medieval Studies at CEU 17 (2011), pp. 41–60 and Zsolt Pinke/ László Ferenczi/ Gyula Gábris/ Balázs Nagy, Settlement Patterns as Indicators of Water Level Rising? Case Study on the Wetlands of the Great Hungarian Plain, in: Quaternary International 415 (2016), pp. 204–215.

6 On Hungary: Lajos Rácz, Climate History of Hungary: Present, Past and Future, Pécs 1999. For the most comprehensive central European documentary evidence based reconstruction, see Petr Dobrovolný et al., Monthly and Seasonal Temperature Reconstructions for Central Europe Derived from Documentary Evidence and Instrumental Records since AD 1500, in: Climatic Change 101 (2010), pp. 69–107.

7 For an overview of the research results up to 2012, see: András Vadas/ Lajos Rácz, Climatic Changes in the Carpathian Basin during the Middle Ages: The State of Research, in: Global Environment 6/12 (2013), pp. 199–227.

back into the Middle Ages or only cover the fringes of the Carpathian Basin (mostly mountainous areas).[8]

The recent emergence of the discipline of environmental archeology has also furthered understanding of medieval environmental (and climatic) changes, such as variations in the long-term hydrological conditions of the Carpathian Basin. It has proven particularly valuable in determining average fluctuations in the levels of lakes and rivers, dating floods and other hydrometeorological events, and – by incorporating research into settlement patterns – in tracing environmental changes within small areas.[9] While there are relatively few excavations addressing the physical environment and the links between settlement location, settlement structure, and environmental change at the present, environmental archeology will surely become a more important factor in future environmental and climate history research. Even given the current state of the research, combining the written historical record with scientific research and these preliminary environmental archeological findings sheds some light on the changes in the late medieval period usually understood in the context of western and central Europe as the initial period of the LIA.

3 The "Great Famine" and Hungary – Problems with and Interpretation of the Sources

According to the timeline established in Hubert H. Lamb's foundational monograph, a period of milder winters, warm summers, and higher precipitation throughout western Europe ended in the late thirteenth century, and a slow cooling period set in that lasted until the sixteenth century, which marks the beginning of the LIA.[10]

8 See the dendroclimatological reconstructions from the Carpathians, most importantly: Ionel Popa/ Zoltán Kern, Long-Term Summer Temperature Reconstruction Inferred from Tree-Ring Records from the Eastern Carpathians, in: Climate Dynamics 32 (2009), pp. 1107–1117.

9 Amongst others see: Erika Gál/ Imola Juhász/ Pál Sümegi (eds.), Environmental Archaeology in North-Eastern Hungary (Varia Archaeologica Hungarica 19), Budapest 2005; Csilla Zatykó/ Imola Juhász/ Pál Sümegi (eds.), Environmental Archaeology in Transdanubia (Varia Archaeologica Hungarica 19), Budapest 2007; P. Sümegi/ S. Gulyás (eds.), The Geohistory of Bátorliget Marshland: An Example for the Reconstruction of Late Quaternary Environmental Changes and Human Impact from the Northeastern Part of the Carpathian Basin, Budapest 2004; Gyöngyi Kovács/ Csilla Zatykó (eds.), "per sylvam et per lacus nimios." The Medieval and Ottoman Period in Southern Transdanubia, Southwest Hungary: The Contribution of the Natural Sciences, Budapest 2016 (with reference to further research).

10 Hubert H. Lamb, Climate: Present, Past and Future. Volume 2. Climatic History and the Future, London – New York 1977. For the problems of periodization, see: Christian Pfister, Five Centuries of Little Ice Age Climate in Western Europe, in: Takehiko Mikami (ed.), The Little Ice Age Climate, Tokyo 1992, pp. 208–213; Jean M. Grove, The Initiations of the 'Little Ice Age' in Regions Round the North Atlantic, in: Climatic Change 48 (2001), pp. 53–82; Jean M. Grove, The Little Ice Age, London

In the 1990s, however, scholars started to classify this earlier transitional period as part of the LIA itself, not primarily because of average temperatures or precipitation levels but due to the growing frequency of weather anomalies and weather-related environmental crises (famines and floods).[11] Recent scholarship suggests a rapid transition to the LIA in the first decades of the fourteenth century.[12]

As a result of these changes in the climate, the conditions for practicing agriculture changed significantly in most parts of western Europe and probably also in east central Europe. The most dramatic changes, however, occurred in northern and northwestern Europe and in mountainous regions (especially the Alps), where the possible zone in which certain grains and grapes could be cultivated shifted to lower altitudes and lower latitudes causing significant economic crises in a number of areas.[13] The situation in the Carpathian Basin during this period was somewhat different: a deep political struggles at the turn of the thirteenth century was followed by the consolidation of the Angevin rule in the early 1320s, which introduced a period of more or less constant economic growth.[14]

Contemporary narrative and legal sources do not mention country-wide famines during this period, and there is little documentation from the Hungarian kingdom on the great plague epidemics of the 1340s.[15] Taken together, this has been read as

2003; Raymond S. Bradley and Philip D. Jones, The 'Little Ice Age': Local and Global Perspectives, in: Climatic Change 48 (2001), pp. 5–8; Rudolf Brázdil et al., Historical Climatology in Europe – The State of the Art, in: Climatic Change 70 (2005), pp. 363–430, here pp. 388–392; Wolfgang Behringer, Kulturgeschichte des Klimas: Von der Eiszeit zur globalen Erwärmung, München 2007, pp. 119–120.

11 Vladimir Klimenko/ Olga Solomina, Climatic Variations in the East European Plain During the Last Millennium: State of the Art, in: Rajmund Przybylak et al. (ed.), The Polish Climate in the European Context. An Historical Overview, Heidelberg 2010, pp. 71–101, here p. 82.

12 See for instance the research project lead by Martin Bauch, The "Dantean Anomaly" Project: Tracking Rapid Climate Change in Late Medieval Europe. Online document: http://www.historicalclimatology.com/projects/-the-dantean-anomaly-project-tracking-rapid-climate-change-in-late-medieval-europe (last accessed: 1 September 2016).

13 On the food shortage, see the foundational monograph by Wilhelm Abel, Agrarkrisen und Agrarkonjunktur in Mitteleuropa vom 13. bis zum 19. Jahrhundert, Berlin 1935 and William Chester Jordan, The Great Famine. Northern Europe in the Early Fourteenth Century, Princeton / NJ 1996. See also on the problem of the usage of the "late medieval crisis" Peter Schuster, Die Krise des Spätmittelalters, in: Historische Zeitschrift 269 (1999), pp. 19–55.

14 On the political struggles of the late Árpádian age, see: Jenő Szűcs, Az utolsó Árpádok [The Last Árpádians], Budapest 1993. On the political consolidation in the 1310s and early-1320s, see: Pál Engel, Az ország újraegyesítése. I. Károly küzdelmei az oligarchák ellen (1310–1323) [The re-unification of the country against King Charles I], in: Századok 122 (1988), pp. 89–147; Gyula Kristó, I. Károly király harcai a tartományurak ellen (1310–1323) [King Charles I's Struggles with the Oligarchs], in: Századok 137 (2003), pp. 297–347. For the economic processes in Hungary, see the recent overview: József Laszlovszky et al. (ed.), The Economy of Medieval Hungary (East Central and Eastern Europe in the Middle Ages, 450–1450 49) Leiden – Boston 2018.

15 Andrea Kiss/ Ferenc Piti/ Ferenc Sebők, Rossz termések, élelmiszerhiány, drágaság, (éh)ínség – és feltételezhető okaik a 14. századi Magyarországon [Bad Harvests, High prices, and Famines – and

evidence that the so-called crisis of the fourteenth century did not affect the Carpathian Basin. Scholars have explained the lack of references in the historical record to these crises in different ways; some attribute it to the more favorable climatic conditions, while others see it as an effect of the Mongol invasion, low population density, or the abundance of rich, arable land.[16]

For nearly a century now, historians have regarded the second half of the 1310s as a period of serious, widespread food shortages in western and moreover northwestern Europe.[17] Research on eastern and central Europe, however, has largely neglected the existence of famines in the period,[18] but in recent years a growing body of scholarship has begun systematically analyzing the regional sources relating to famines from the 1310s. Finnish, Czech, Hungarian, Polish, and German scholars have also re-evaluated earlier known sources and discovered new evidence on the problem.[19] Not only have

---

Their Possible Background in 14th-Century Hungary], in: György Kövér/ Ágnes Pogány/ Boglárka Weisz (eds.), Magyar Gazdaságtörténeti Évkönyv 2016: Válság – Kereskedelem [Hungarian Economic History Yearbook 2016: Crisis – Trade] Budapest 2016, pp. 23–79. When writing the paper I had no access to this extremely important study in the topic yet. For data on the great plague in Hungary, see: Erik Fügedi, A középkori Magyarország történeti demográfiája [Historical Demography of Medieval Hungary] (Történeti demográfiai füzetek 10), Budapest 1992, pp. 28–29.

16 See e.g. József Laszlovszky, "Per tot discrimina rerum" – Zur Interpretation von Umweltveränderungen im mittelalterlichen Ungarn, in: Gerhard Jaritz/ Verena Winiwarter (eds.), Umweltbewältigung: Die historische Perspektive, Bielefeld 1994, pp. 37–55.

17 Henry S. Lucas, The Great European Famine of 1315–7, in: Speculum 5 (1930), pp. 343–377.

18 E.g. Grzegorz Myśliwski, Central Europe, in: Harry Kitsikopoulos (ed.), Agrarian Change and Crisis in Europe, 1200–1500, New York 2012, pp. 250–291.

19 For Finland and northeastern Europe, see: Heli Huhtamaa, Frosts, Floods, and Famines – Climate in Relation to Hunger in North-East Europe A. D. 1100–1550, MA Thesis, Joensuu 2011, pp. 50–53 and her study in the present volume. For Poland: Myśliwski (note 18), p. 259. For Hungary: Andrea Kiss, Some Weather Events from the Fourteenth Century, II. (Angevin Period: 1301–87), in: Acta Climatologica Universitatis Szegediensis 32–33 (1999), pp. 51–64; Richárd Szántó, Az 1315–17. évi európai éhínség [The famine of 1315–1317], in: Szabolcs Marton/ Éva Teiszler (eds.), Medievisztikai tanulmányok. A IV. medievisztikai PhD konferencia előadásai [Studies in Medieval History. Proceedings of the 4th PhD-Conference in Medieval Studies], Szeged 2005, pp. 135–142; András Vadas, Documentary Evidence on the Weather Conditions and a Possible Crisis in 1315–1317: Case Study from the Carpathian Basin, in: Journal of Environmental Geography 2/3–4 (2009), pp. 23–29. For the Czech lands, see: Rudolf Brázdil/ Oldrich Kotyza, History of Weather and Climate in the Czech Lands I: Period 1000–1500 (Züricher Geographische Schriften 62), Zürich 1995, 166–167; Robert Antonín/ Michaela Malaníková, Když se jídla nedostává. České středověké reflexe hladových let v evropském kontextu ["When One is Not Fed" – The Medieval Relations about "the Years of Hunger" in the Central European Region], in: Beata Możejko/ Ewa Barylewska-Szymańska (eds.), Historia naturalna jedzenia. Miedzy antykiem a XIX wiekiem [Natural History of Food. Between Antiquity and the 19th Century], Gdańsk 2012, 70–80. For Austria: Christian Rohr, Extreme Naturereignisse im Ostalpenraum. Naturerfahrung im Spätmittelalter und am Beginn der Neuzeit, Köln 2007; for German areas, see, e.g., Tim Erthel, Der Schmidtstedter Gedenkstein von 1316. Ein seltenes Kleindenkmal der spätmittelalterlichen Klima- und Kulturgeschichte Erfurts, in: Mitteilungen des Vereins für Geschichte und Altertumskunde Erfurts N. F. 17 (2009), pp. 8–16,, Rudolf Brázdil/ Oldřich Kotyza/ Martin Bauch, Climate and famines in

the 1310s received more attention in recent scholarship, but researchers have also begun re-evaluating the question of famines in the Carpathian Basin. Though references to them are missing from the domestic narratives of the period, a number of fourteenth-century legal documents do refer to food shortages.[20] The next few paragraphs survey the available written sources which provide evidence of food shortages in the 1310s in the Hungarian kingdom.[21]

The first such document is a charter from 1343, a transcription of another document from 1312, which highlights the food supply in the 1310s. The charter is a seemingly straightforward documentation of the sale of an estate called *Pethunye*, but it specifies that anticipation of shortages in the near future was the reason for the sale of one sixth of this estate. The charter was issued on June 25, 1312, shortly before the grain was typically harvested, which indicates that there may have been expectations of a poor harvest. This does not mean that there was a widespread crop failure; the charter does not specify the reason for the supposed shortage in the coming year, but it is possible that it was due to weather conditions.[22]

While there is no other legal source referring to food shortage or related events from the first half of the 1310s, foreign narratives and non-contemporary chronicles provide another source of information on problems in the 1310s. Although there is no contemporary domestic evidence which expressly mention a wide-spread famine in the first half of the 1310s, a later chronicle of the Spiš region (northernmost area of present-day Slovakia) is interesting. Compiled in the seventeenth century by Caspar Hain, this account draws partly on local archival evidence and reports that there was a famine around 1312 that lasted three years. Hain even mentions cannibalism among the population,[23] though, under the circumstances, this might reflect the vivid imagination of a seventeenth-century author, despite the fact that scholars, including

---

the Czech Lands prior to AD 1500, in: Dominik Collet/ Maximilian Schuh (eds.), Famines During the 'Little Ice Age' (1300–1800) (Socionatural Entanglements in Premodern Societies), Heidelberg 2017, 91–114; and Martin Bauch, Jammer und Not. Karl IV. und die natürlichen Rahmenbedingungen des 14 Jahrhunderts, in: Český Časopis Historický 115/4 (2017), pp. 983–1016.

20 See Andrea Kiss's contribution to this volume. See also the works of Andrea Fara, esp. Production of and Trade in Food Between the Kingdom of Hungary and Europe in the Late Middle Ages and Early Modern Era (Thirteenth to Sixteenth Centuries): The Roles of Markets in Crises and Famines, in: Hungarian Historical Review 6 (2017), pp. 138–179. See also: Myśliwski (note 18).

21 For an earlier collection of the weather events of the period, see: Vadas (note 19). I will not refer here to data that is not related to food shortages or famine. For floods and other weather events, consult the article quoted above, and Kiss (note 4), pp. 238–239.

22 Hungarian National Archives, State Archives, Collection of Diplomatics (MNL OL DL) 71 639. Edition: László Bártfai Szabó (ed.), Oklevéltár a gróf Csáky család történetéhez, I/1 [Cartulary to the history of Csáky family], Budapest 1919, pp. 88–92: *possessionem Pethunye vocatam videlicet duorum aratrorum tercie partis dimidiam ipsos contingentem propter anni tunc cernetibus caristiam et sumptus necessarios vendicioni exposuissent*.

23 Jeromos Bal/ Jenő Förster/ Aurél Kauffmann (eds.), Hain Gáspár lőcsei krónikája [The Chronicle of Caspar Hain of Levoča], Lőcse 1910–1913, p. 13: *Zu dieser Zeit war auch 3 Jahr lang so groszer*

Henry Lucas, have argued that this phenomenon was not unique in times of famine.[24] In spite of its probable exaggerations and the fact that it is not an contemporary evidence, this chronicle is an important source, as the author was the town judge in Levoča with ready access to the town archives. Some of his references suggest that he was familiar with medieval chronicles or annals which have since been lost, so his descriptions of the medieval period in the town should be considered as well.[25] Of course there are general methodological problems with the use of early modern chronicles such as the lack of references and the creative license of the chroniclers of the period that make it difficult to separate historical fact from fiction. However, Hain seems to have been aware of the need to cite the earlier sources on which he based his work. For the period after 1516, he specifies which sources he used when compiling the chronicle, including Konrád Sperfogel, Dániel Türk, Márton Frőlich, and others. They were all local office-holders and prominent members of the bourgeoisie of Levoča in the sixteenth and seventeenth centuries.[26] A recent study significantly suggests that Hain probably used medieval annals on the history of the region, perhaps the work he referred to as the Annals of Levoča.[27] These annals have a secular background but they may also have contained some transcriptions of religious annals, as well, for Hain's work contains a large number of references to the foundations of monasteries and religious events, especially in present-day Slovakia.[28] He dates the foundation of the Cistercian monastery of Spišský Štiavni (Slovakia) to 1216, which is indeed the generally accepted date for this monastery's foundation, but he misdated, for instance, the foundations of the monasteries of Gelnica and Prešov.[29] There are a number of mistakes in the Hain chronicle, but, apart from an entirely made up part

Hunger, das die Menschen einander geschlachtet und gessen auch die Diebe von Galgen sind vor Hunger abgeriszen worden. Desgleichen war auch undter dem Viehe.

24 On the question of the cannibalism from 1315 to 1317, see: Lucas (note 17), pp. 343–377, and on cannibalism as a trope in the High Middle Ages, and even more so in the early modern era, see: Cătălin Avramescu, An Intellectual History of Cannibalism, Princeton / NJ 2009.

25 On the sources and the reliability of Caspar Hain's chronicle, see the very recent work which draws previous literature: András Péter Szabó, Caspar Hain lőcsei krónikája – egy kompiláció forrásai [The Chronicle of Caspar Hain of Levoča], in: Gergely Tóth (ed.), Clio inter arma. Tanulmányok a 16–18. századi magyarországi történetírásról [Studies in the History of 16th–18th-Century Historiography in Hungary] (Monumenta Hungariae historica. Dissertationes), Budapest 2014, pp. 169–202. On the medieval parts of Hain's chronicle, see ibid., pp. 190–198.

26 On the period of their activity in Levoča, see: Kálmán Demkó, A Szepes-szombati krónika [The Chronicle of Spišská Sobota], Lőcse 1891, pp. 15–16. Hain himself also refers to early modern humanist chronicles such as Ortelius's and Istvánffy's chronicles (Bal/ Förster/ Kauffmann [eds.] [note 23], p. 3), however these latter ones are sometimes more unreliable than the later works of the dignitaries.

27 Szabó (note 25), p. 198.

28 Bal/ Förster/ Kauffmann (eds.) (note 23), p. VI.

29 For the correct foundation dates, see: Beatrix F. Romhányi, Kolostorok és társaskáptalanok a középkori Magyarországon. Katalógus [Monasteries and Collegiate Chapters in Medieval Hungary. Catalogue], Budapest 2000.

on the prehistory of the Spiš region, these are probably not intentional. Therefore, it is quite likely that a famine did affect the northern part of the Hungarian kingdom sometime in the early or mid-1310s.[30] Although Hain dates this event to three years around and after 1312, he also added that the exact date was uncertain. Whether or not the famine was linked to the weather or other factors is an open question, but it is worth noting that, as in the aforementioned case of *Pethunye*, the environmental conditions of the Spiš region were quite unfavorable for agriculture.

There is at least one further reference to the famine in legal evidence from the 1310s: in 1318 a group of nobles from the village of *Zeuleus* (Szőlős, present-day Balatonszőlős) took an oath to the convent of Tihany, a significant Benedictine abbey in Transdanubia (western Hungary). According to the document, the abbey cared for its tenant peasants by protecting and nourishing them during hardships and famine. The reference to famine is a valuable hint as the event described may have taken place precisely in the years of the documented "great famine."[31] The question of protection also raises a very important point already mentioned above: when the rule of the Árpádian dynasty ended, the Hungarian throne was left unoccupied, and the subsequent period was one of the most anarchic eras in the history of the kingdom. A number of powerful oligarchs and dynasties tried to seize the Hungarian throne. The consolidation of the rule of Charles I and the Angevins was a long process of which his third, and lawful, coronation, on August 27, 1310, was the starting point rather than the end.[32] The scholarship generally considers the period between 1310 and 1323 as a decisive phase in the reunification of the country and in the cementing of Angevin rule. Under such political circumstances, the protection by an ecclesiastical institution may have been crucial.

Military campaigns had a great impact on the communities affected; armies caused considerable crop damage when they marched through a given region, especially around harvest time. In the years addressed in this study, such campaigns were frequent. On May 19, 1317 the king issued a charter granting estates to János,

30 For the low historical value of the prehistoric section, see: Bal/ Förster/ Kauffmann (eds.) (note 23), p. VI and its introduction.

31 Imre Nagy/ Dezső Véghely/ Gyula Nagy (eds.), Zala vármegye története. Oklevéltár 1. 1024–1363 [The History of Zala County. Cartulary], Budapest 1886, pp. 146–147 (No 110): *Demetrius Tykon et Nicolaus Vruslan dictus filii Arnoldi filii Foluyne pro se et pro Paulo fratre ipsorum, Ladizlaus et Demetrius filii Volpoth de Zeuleus, in nostri presencia personaliter constituti, attendentes et considerantes favorem et benivolenciam ecclesiarum, et maxime Wesprimiensis ecclesie, ac venerabilis patris domini Stephani dei gracia episcopi et prelati ecclesie ac perpetui comitis loci eiusdem, quibus hoc tempore impaccato, famis et inedie in fovendis, alendis, nutriendis, defendendis et protegendis, suos fovit, nutrivit et protexit, et ut speratur in premissis semper suum laudabile factum, in eorumdem personis recipiet incrementum, cum omnibus ipsorum possessionibus in eadem Zeuleus.*

32 See the most recent overview of the period, the special issue of Hungarian Historical Review 2 (2013), pp. 211–386 (ed. Tamás Pálosfalvi); Enikő Csukovits (ed.) L'Ungheria angioina (Bibliotheca Academiae Hungariae – Roma. Studia 3), Roma 2013.

son of Péter Popdi, as compensation for the damage the royal armies had done to his other estates.[33] Although not documented during this decade, there are cases in other periods when the lack of food in a certain region was connected to ongoing military campaigns; this might have been the case in the 1310s, as well.[34] Although significantly fewer soldiers were involved in these military expeditions than in later campaigns in the early modern era, the armies could still have serious consequences in smaller areas, especially if they passed through during a crucial phase of the agricultural cycle: i.e., in late spring, early summer, or at harvest time. This could easily explain why protection was a key issue both for noble families and peasants.

Medieval narrative sources offer very little information on the famines in the early fourteenth century or, more precisely, the 1310s in the Hungarian kingdom. The period's most extensive source, the so-called "Fourteenth-Century Chronicle Composition" does not list any major famines in this period.[35] While some traces of the elements of the "Dantean Anomaly" posited recently by Martin Bauch may have occurred in the Hungarian kingdom just as they did in other parts of central Europe (Bohemia, Poland, or the German empire), there is virtually no information on the extent of the famines mentioned. It is impossible to deduce whether these were limited local or regional problems.

4 The Long-Term Impacts of the LIA in the Carpathian Basin – Where to Look?

As noted above, a second, no less relevant problem is the possibility of tracing long-term changes in the fluctuation of the hydrological conditions in the Carpathian Basin going back to the medieval period. To date, there are no relevant reconstructions based on written evidence for the medieval period, and, even up to the eighteenth century, a number of uncertainties complicate the reconstructions, making them either impossible or unreliable.[36] The same is true for temperatures and precipitation, but historical,

33 Imre Nagy/ Gyula Tasnádi Nagy (eds.), Anjoukori Okmánytár. Codex diplomaticus Hungaricus Andegavensis, I, Budapest 1878, pp. 424–425.

34 E.g., a charter from 1321: MNL OL Collection of Diplomatic Photographs (DF) 209 129. Edited in: Imre Nagy (ed.), Hazai okmánytár. Codex diplomaticus patrius, vol. 4, Budapest 1867, pp. 130–131.

35 For a recent Latin-Engish bilingual edition of one of the text's versions: János M. Bak/ László Veszprémy (ed.) The Illuminated Chronicle: Chronicle of the Deeds of the Hungarians from the Fourteenth-Century Illuminated Codex (Central European Medieval Texts 9) Budapest, New York 2018.

36 The existing ones: Judit Bartholy/ Rita Pongrácz/ Zsolt Molnár, Classification and Analysis of Past Climate Information Based on Historical Documentary Sources for the Carpathian Basin, in: International Journal of Climatology 24 (2004), pp. 1759–1776; Rácz (note 6) and Lajos Rácz, Magyarország éghajlattörténete az újkor idején [Climate history of Hungary in the Modern times], Szeged 2001. On their problematic handling of the sources, see: Kiss (note 2), pp. 316–320.

archeological, and scientific research in the last few decades have highlighted some medium- or long-term trends of medieval water levels. A number of factors influence such fluctuations: changes in riverbeds, changes in vegetations, the felling of forests, etc. Such processes are evident in a few sites that allow some conclusions regarding the changes in hydrological conditions of the Carpathian Basin during the medieval period.

Drawing on a variety of sources, scholars have a deduced that the water level in a number rivers were significantly lower in the Árpádian period (ca. 1000–1300) than in the late Middle Ages, and that a major flood peak occurred in the late fifteenth or early sixteenth century. Much of this data comes from the Danube valley. Individual case studies in the vicinity of the Danube Bend (some 25 kms north of Budapest) have generally found a significant rise in the average level of the Danube in the late medieval period and a corresponding elevation of the groundwater tables along the banks of the river. Soil science research in connection with a never-realized dam project (part of the Gabčíkovo–Nagymaros Dams) at Nagymaros revealed that there had been a catastrophic flood in the late Middle Ages or the first phase of the early modern era.[37] Data from Visegrád, both from the royal palace[38] and from the so-called "New Town" ("Újváros" in Hungarian) as well as from the left bank of the Danube (Vác), suggests that the shift in the hydrological regime of the Danube took place at some point around the end of the Middle Ages.[39]

Similar processes were identified at sites in present-day Budapest.[40] A number of ecclesiastical institutions in the Middle Ages were situated on Margaret Island, in the Danube between Pest and Buda, including one of the wealthiest such institutions in the medieval Hungarian kingdom, a Dominican nunnery founded by King Béla IV, who had been the Hungarian monarch in the during and the aftermath of the Mongol invasion. The whole island was, however, more or less a lower floodplain and thus endangered by flooding; a thirteenth-century miracle narrative refers to the problem of floods reaching the Dominican convent.[41] In the sixteenth century, the high water of the Danube seems to have been more serious and, more importantly, a recurrent problem: for one thing, archeological excavations suggest that the floors were raised

37 András Pálóczi Horváth, Nagymaros rétegviszonyainak kutatása [Research into the layers at Nagymaros], in: Tibor Kemenczei (ed.), Dunai Régészeti Híradó 1. Régészeti feltárások a dunai vízlépcsőrendszer területén 1978-ban [Danube Archeological Reports. Archeological Excavation at the Territory of the Danube Barrage in 1978], Budapest 1979, pp. 47–51.

38 Kiss/ Laszlovszky (note 5).

39 Mészáros/ Serlegi (note 5), pp. 200–201, 207–214.

40 See also, on the mid-section of the Danube in Hungary and Óbuda (present-day Budapest): István Viczián, Archaeological sites on large river's islands as records of Holocene climate and fluvial changes. A geomorphological case study in the Danube river section between Komárom and Paks, Hungary, in: Analele Universitatii Ştefan cel Mare din Suceava Seria Geografie 24 (2014), pp. 176–180.

41 Kiss (note 4), pp. 228–232; Vadas (note 5).

in a number of parts of the nunnery friary, and legal evidence also provides additional proof that flooding reached higher levels than used to be typical.[42]

Although there is a relative abundance of charters relating to the institution in the late medieval period, most of these do not concern Margaret Island itself but rather more distant estates which belonged to the nunnery. One extremely important charter from the early sixteenth century, however, demonstrates very well what kind of sources may help reconstruct climatic phenomena in areas where narrative sources are relatively scarce. Thommaso de Vio, a papal legate and cardinal, issued a charter on September 5, 1523, granting the nunnery of Margaret Island permission to move the remains of "Blessed Margaret." Margaret, the daughter of the aforementioned Béla IV, had spent her entire adult life in the nunnery in the mid-thirteenth century; after her death and burial somewhere in the church of the nunnery, she became the subject of a growing cult. According to an early sixteenth-century member of the convent, Lea Ráskai, renovations of the church's sanctuary began in 1510. Circumstantial evidence suggests that Margaret's grave was opened at some point between 1510 and 1512, probably due to this restoration work. The princess's remains were consequently transferred to some point outside the church but within the cloistered area of the nunnery.[43]

Because the cloister was not open to pilgrims, however, Margaret's earthly remains were no longer accessible to the public. The primary reason for the nuns to show Thommaso de Vio the place where Margaret's bones were kept was to procure permission from the cardinal to move the relics to a location where pilgrims could view them – donations from these visitors were an important source of income to the nuns. One of the possible locations for Margaret's body was the church, of course, which by the early 1520s had certainly been restored. Because Margaret was not actually canonized at that point (and not until 1943), however, it was not clear whether her bones should be put on display for veneration. The church would have been an obvious choice, as it was open to pilgrims for the majority of the year. In 1499, in fact, the nuns had been granted permission to visit Margaret's remains in the church for only ten (!) days per year. This implies that the burial place of Margaret (and that of his brother King Stephen V) was open to the wider public for the rest of the year.[44]

According to the charter the legate issued, he had visited the place where Margaret's relics were kept in 1523. For the purposes of the present study, the charter's reasoning regarding the act of relocation is of primary importance: the nuns ask for permission to move Margaret's bones because their present location is subject to

42 See Vadas (note 5), pp. 77–79.

43 Lajos Némethy, Adatok Árpádházi Boldog Margit ereklyéinek történetéhez [Data on the History of the Relics of Blessed Margaret], Budapest 1884, pp. 26–34; Ilona Király, Árpádházi Szent Margit és a sziget [Saint Margaret and the Island], Budapest 1979, pp. 143–144.

44 András Harsányi, A domonkos rend Magyarországon a reformáció előtt [The History of the Dominican Order in Hungary before the Reformation], Debrecen 1938, p. 105.

the flooding of the Danube.[45] According to the nuns, the problem was not that one disastrous flood had reached the nunnery but rather that the nunnery was exposed to flooding on a regular basis. Unfortunately, the petition does not specify the location of the relics at that time, but it is highly unlikely that the nuns had placed their most precious object at a place where it was exposed to destruction in the early 1510s, meaning that the situation had changed since then. Of course, the nuns' mention of the flood danger in this case could have been a ploy to convince the legate that it was necessary to bring Margaret's relics back into the church where her remains would be available for veneration despite the fact that her canonization was still pending. Nevertheless, it is probable that their argument was not entirely fallacious and that parts of the enclosed area of the nunnery were flooded from time to time around 1520.

In areas beyond the Danube valley, there is also evidence that water levels and flood danger rose after the Árpádian era, but most of this evidence is the result of scientific analysis and archeological excavation rather than analyses of written sources. In Transdanubia, a research project which studied the environmental changes in the area along the River Dráva (the modern Hungarian-Croatian border)[46] found that excavation sites belonging to the Árpádian period were at lower elevations than late medieval sites, which suggests rising water levels in the later Middle Ages. In addition, the existence of a number of small lakes in the alluvial plain around the river during the early modern period provides additional evidence of increased water levels.[47]

Not only the rivers but also the lakes show similar patterns in Transdanubia. As for the early medieval period (i.e., before the Hungarian Conquest in the late ninth century), archeological data is the most important source for historical hydrological investigations. In the area around Lake Balaton, numerous cemeteries and the settlement complex at Zalavár (Mosaburg) – situated on the shores of the Kis-('Small') Balaton, a huge wetland area southwest of Lake Balaton – have received considerable attention in the scholarship. Most studies conclude that low water levels prevailed in the Conquest period.[48] In addition to these archeological investigations, a charter

45 *Cum nuper apud monasterium vestrum diverteremur, ostensa nobis per vos fuerunt ossa beatę Margaretę virginis monialis vestrę filię quonadam clarę memorię Belę quarti regis hungarię in loco ut asserebatis exposito aquarum inundationibus. Et quoniam illam vitę sanctimonia non minus quam prosapia claruisse asserebatis nobis humiliter supplicastis ut illa inde transferri et in loco decentiori in quo inundationes huiusmodi non officerent poni permitteremus* – MNL OL DL 25 312, for the most recent edition of the charter, see: Antonín Kalous, Plenitudo potestatis in partibus? Papežští legáti a nunciové ve střední Evropě na konci středověku (1450–1526) [Papal Legates and Nuncios in Late Medieval Central Europe], Brno 2010, p. 379.

46 For the final report on the project, see: Kovács/ Zatykó (eds.) (note 9).

47 István Viczián, Geomorphological Research in and around Berzence, on the Border of the Drava Valley and Inner Somogy Microregions, Hungary, in: Kovács/ Zatykó (eds.) (note 9), pp. 75–91, esp. pp. 82–83.

48 Károly Sági, A Balaton szerepe Fenékpuszta, Keszthely és Zalavár IV–IX. századi történetének alakulásában [The Role of Lake Balaton in the 4th–9th-Century History of Fenékpuszta, Keszthely,

from 1335 allows for the reconstruction of the water level here with relative accuracy. This research suggests that the water levels were rising but still below modern (but pre-systematically regulated) average in the period between ca. 900 and 1335.[49] Scientific data for this period also confirms rising water levels in Lake Balaton, but varied reconstructions show considerable differences in the extent of the area affected by this process.[50] Highway constructions in the last twenty years along the southern shoreline of Lake Balaton unearthed archeological evidence of settlements proving that many of the Árpádian sites disappeared by the late medieval period because they were situated at lower elevations and were likely endangered by water rising in the plains around the lake.[51] As has been demonstrated for the western (and partly for the northern) shore of Lake Balaton,[52] the water table also changed, which could have affected large areas that had previously been inhabited or suitable for cultivation. Some authors, however, point out that local populations regulated or at least influenced the water level of the lake. Though there may not yet have been a flood gate constructed primarily for regulating water levels in the Middle Ages, the huge mill complex not far from the present-day flood gate at Siófok may have functioned partly as such.[53] Despite doubts concerning the correlation between the fluctuation of water levels of Lake Balaton and precipitation in its catchment area, rising water levels have also been demonstrated along the shores of other lakes, such as Lake Fertő (northwestern Hungary/eastern Austria).[54]

In the eastern part of the Carpathian Basin, a number of studies have reached a similar conclusion. Settlements along rivers and mort-lakes in the Danube-Tisza Interfluve area follow a comparable pattern. Szabolcs Rosta's recent study of medieval routes which passed through the Kiskunság region made some important contributions concerning the late medieval topography of the village of Akasztó. As Rosta explains, the environmental situation of the area surrounding the settlement is quite problematic; the roads leading to the closest market town, Kiskunhalas, would have had to cross the so-called "Nagy-Sár" ("big mud"), which was, at least in the late medieval and early modern period, true to its name, a marshy area. The presence of trade

and Zalavár], in: Antik Tanulmányok 15 (1968) pp. 15–46. See more recently, with slightly different results: Maxim Mordovin, The Building History of Zalavár-Récéskút Church, in: Annual of Medieval Studies at CEU (2006), pp. 9–32, esp. p. 12.

49 MNL OL DF 253 832. Published in: Nagy/ Véghely/ Nagy (note 31), pp. 294–307 (No 206).

50 Vajda (note 5).

51 Mészáros/ Serlegi (note 5).

52 Most recently, see: Tamás Pusztai, A tapolcai bencés apátság építéstörténete [Building History of the Benedictine Abbey of Tapolca], in: A Hermann Ottó Múzeum Évkönyve 52 (2013), pp. 149–170., esp. p. 161.

53 For the mills there, see: Andrea Kiss, "Rivulus namque, qui dicitur Fuk, fluens de prefato lacu" – Fok, Sár, Foksár, in: Bertalan Andrásfalvy/ Gábor Vargyas (eds.), Antropogén ökológiai változások a Kárpát-medencében [Anthropogenic Ecological Changes in the Carpathian Basin], Pécs 2009, pp. 49–63.

54 Kiss (note 5).

routes through the area in the earlier Middle Ages at least calls into question whether it was marshland at that stage.[55] Not far from the area, in the valley of the Tisza at Szer (Ópusztaszer), research has highlighted how the settlement "moved" towards higher elevations in the late medieval period, probably to escape the flooding of the Tisza which affected the area. Archeological topographies indicate clearly that many settlements on the Great Hungarian Plain from the Árpádian era were not rebuilt after the Mongol invasion (1241/42), and new dwellings were often built in the vicinity of old villages, on higher terraces protected from potential floods.[56] In the eastern part of the Great Hungarian Plain, a recent study has documented this process not only at sporadic sites, but at a general regional level,[57] by comparing average elevations of high Árpádian and late medieval (fourteenth to early sixteenth century) archeological sites – including settlements, churches, and cemeteries situated in the heartland of the wetlands that covered a huge part of the Great Hungarian Plain. The area studied covered roughly four thousand square kilometers (nearly five percent of the territory of present-day Hungary). The average elevation of the late medieval archeological site group was significantly higher than that of the Árpádian period. On the other hand, the paper pointed out that the desertion of specific areas and settlements could have been partly due to their direct vulnerability to flooding, but also, to some extent, to the potential inundation of roads that would have resulted in the settlements' being isolated and cut-off from existing networks.

Despite the lack of precise information on long-term changes in the climatic conditions of late medieval Hungary, the abundance of circumstantial evidence gathered above does permit at least some conclusions. In at least more than dozen individual study areas in the Carpathian Basin, research has found that water levels rose from the late Árpádian period up to the late sixteenth or early seventeenth century. Such changes can be attributed to a number of factors: changes in the agricultural techniques, the felling of forests, and, of course, changes in the climate, to name just a few. While some scholars attribute the whole process to the LIA and increasing precipitation during this period, they would do well to resist this temptation. Recent

55 Szabolcs Rosta, A Kiskunsági Homokhátság középkori település- és úthálózata [Medieval Settlement and Road Network of the Homokhátság Region, Kiskunság], in: Balázs Nagy (ed.), Középkori mozaik [Medieval Mosaic], Budapest 2010, pp. 101–148.

56 Katalin Vályi, Szer középkori településtörténete a régészeti leletek tükrében [Medieval Settlement History of Szer in Light of Archeological Data], in: László Novák/ László Selmeczi (eds.), Falvak, mezővárosok az Alföldön [Villages, Market Towns at the Alföld] (Az Arany János Múzeum Közleményei 4), Nagykörös 1986, pp. 119–124. For instance, from Békés County (southeastern Hungary), see: Dénes Jankovich B. (ed.), Békés megye régészeti topográfiája. Békés és Békéscsaba környéke [Archeological Topography of Békés County. Surroundings of Békés and Békéscsaba] (Magyarország régészeti topográfiája 10), Budapest 1998, pp. 673–677 (Nos 12/8, 12/9); János Makkay (ed.), Békés megye régészeti topográfiája. A Szarvasi járás [Archeological Topography of Békés County. District of Szarvas] (Magyarország régészeti topográfiája 8), Budapest 1989, p. 367 (No 7/99).

57 Pinke/ Ferenczi/ Gábris/ Nagy (note 5).

research, for example, has not demonstrated a clear increase in regional precipitation sufficient to explain the clear shift in the water table. While climatic change may have influenced settlement patterns in the Carpathian Basin, changes in agricultural techniques, like the shift towards herding cattle, may also have been as influential in some areas as changes in precipitation.

5 Conclusions

This paper aimed to highlight possibilities for research on short- and long-term climatic and environmental processes in an area usually considered poor with regard to written evidence. Despite the scarcity of narrative sources and the limits this scarcity places on the research possibilities in the study of events related to weather in the medieval Hungarian kingdom, other genres of evidence – e.g., legal documents – have considerable potential for climate history research as Andrea Kiss and others have recently demonstrated. The two aspects this short article addresses do certainly not reveal much about either the Hungarian research potential for the whole of the Middle Ages or the climatic processes of the same area, but they do (hopefully) show that historical evidence can be combined with scientific and archeological data to significantly advance the understanding of some environmental processes if not climate itself.

The title of the article asks to what extent historians and scientists can provide evidence of the LIA using the sources available for the region. The answer very much depends on how the data presented here is interpreted, i.e., to what extent the presence of food scarcity or famine in distant regions of Hungary during a period of constant warfare can be attributed to the same factors as famines in northern France or Scandinavia. The situation is equally ambiguous regarding potential connections between the LIA and rising water levels in the Carpathian Basin. What is nevertheless quite clear is that a major transformation in the environmental conditions in the region occurred from the late thirteenth century onwards. Perhaps the more important task facing scholars is to understand the different factors contributing to this transformation in more detail understanding rather than pursuing a search for traces of the LIA.

Richard C. Hoffmann

Thoughts on a Connected Fourteenth Century

Abstract: As to be expected in collective volumes organized around a theme like this one, the concluding commentary aims to compare and contextualize the chapters. Scales, locations, sources, and methods of the studies vary but two main conclusions can be drawn: natural events are found to have had significant impacts on fourteenth-century societies; and the likelihood of some linkages among both widespread and local natural and cultural phenomena deserves continued purposeful investigation. Analytical concepts of 'teleconnections' and 'crisis' are explored and critiqued as tools for understanding this historic period. Some directions for further research are indicated.

Keywords: crisis; 14th century; Europe; teleconnections; environmental forces; cultural forces; historical methodologies; comparative perspectives

Fourteenth-century Europe is retrospectively diagnosed as being in 'crisis'. Historical usage can be ambiguous, whether applying the term to catastrophic natural events of the 1310s–40s culminating in the plague epidemic of 1347–51, to the socio-economic effects of these, to politico-military disasters, or to longer-term conditions of demographic collapse, agrarian depression, commercial disarray, and cultural despair. Potential confusion hampers efforts to understand and explain. Plainly natural and cultural forces interacted, but how is this to be observed and interpreted? The editors' introduction to this book proposes a pragmatic approach seeking interdisciplinary data sets to identify the triggers and drivers of change and response at multiple scales. When anomalous conditions extend over large temporal and spatial distances yet remain apparently parallel these 'teleconnections' need to be tested and explained. The core issue this book thus sets before its readers is the extent to which natural and socio-cultural phenomena in the fourteenth century may be thought independent or somehow related manifestations of larger systems.

Approaching the essays in this book as an environmental historian concerned to understand the multi-sided coevolution of medieval European society and its natural surroundings, I would identify their common and variant elements and observe how both features contribute to improved knowledge of environment-human relations in the 14th century and further directions for research. This will slide into some thoughts about the interpretive concept which hovers over the volume, namely 'teleconnection' and its links to historic crisis.

Richard C. Hoffmann, Department of History, 2140 Vari Hall, York University, 4700 Keele Street, Toronto, Ontario M3J 1P3, Canada

Open Access. © 2020 Richard C. Hoffmann, published by De Gruyter. This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-014

After reading a work of historical scholarship it is reasonable to ask 'What have we learned about some piece of the past?" and/or 'How did the author or authors use surviving textual or material remnants of the past to make truth-claiming statements about the world whence those came?' The first answer may vary with the reader's prior experience; the latter more depends on close reading of relevant evidence and clear argument. More than a dozen lead contributors to this book have brought various historical methods and reasoning to bear on a doubly-vexing topic, namely a great upset or hiatus after around 1300 in human societies of western Eurasia and the relative roles of human and non-human forces in shaping those events and their outcomes. As in other recently published works these authors collectively advance a decidedly more balanced engagement of natural and cultural agents in what has conventionally become 'the 14th century crisis'. Or is it 'crises'? Accepting nature as a historical protagonist while refusing *a priori* expectations of either cultural or natural determinates are hallmarks of environmental history research. In the introduction editors Martin Bauch and Gerrit Schenk described several perspectives and paradigms to explore possible interactions and outcomes.

Essays in this volume centre on the 14th century, notably its first half, and on questions of environmental variability and its impact on premodern societies. Most of the latter here were located in western Latin Christendom, but some authors bring important perspectives from that culture's eastern margins (northeastern Europe, Byzantium) and its more distant neighbours in China. Contributors pay special attention to the period's signature events: crop failures, epizootics, and famine ca.1315–21; widespread floods and food shortages in the 1330s–40s; the coming of the Black Death, 1347–51; a great windstorm and widespread coastal flooding in 1362. The largest group of papers – by Andrea Kiss et al., Thomas Labbé, Tana Li, Johannes Preiser-Kapeller/Ekaterini Mitsiou, Rainer Schreg, and András Vadas – look for short and long-term preconditions and triggers both natural and socio-cultural. Those of Chantal Camenisch, Heli Huhtamaa, and Maximilian Schuh include critical assessments of sources from both the cultural and natural record to establish or refine parameters of events or trends. Certain writers here – Peter Brown, Marko Halonen, Paolo Nanni, and Maximilian Schuh – highlight contemporary perceptions, representations, and responses to experiences of natural variability. An undercurrent thus swirls between the emic perceptions and understanding of people with lived experience of the turbulence and the etic view of present-day observers and explanations. Both approaches are germane to grasping material drivers, socio-cultural responses, and the necessarily hybrid socio-natural results.

Essential 'take-aways' from this book are two-fold. First are the indubitable impacts that natural events had on affected societies, in each instance more or less commensurate with the scale of the event and antecedent cultural and political structures. Does this evident fact really still require continual justification? Perhaps. While few if any working environmental historians espouse anything resembling environmental (including climate) determinism, certain widely-distributed popular writers

and some physical scientists do continue to preach mechanistic straight lines from geography, climate, weather, and even human environmental modifications to specific historical and future social formations and cultural features. On the other hand numbers of cultural analysts, medievalists among them, still purposely avert their eyes from the natural forces well known to prevail in premodern Europe. Yet neither the arrival in Europe of the bacillus *Yersinia pestis* nor the destruction of Basel by earthquake in 1356 were simply cultural constructs. So the worries Nanni and Labbé express in their essays may not after all be beating the dead horse perceived by colleagues working in other historiographic discourses.

Precise effects of gradual or catastrophic natural fluctuations varied with regional or local situations wherein human decisions shaped social responses and outcomes. The otherwise rather different approaches of Nanni and Huhtamaa converge at this recognition. In the 21st century no serious student of the Middle Ages in general and their latest centuries in particular ought approach even cultural artifacts unaware of the documented environmental experience of those who created and used those artifacts. Even arguing that a particular object or behavior was apparently unaffected by material conditions of life should consider why this was the case.[1]

A second rich harvest to be gleaned from this book are the visible, though not invariant, connections it reveals, mainly as temporal coincidence or sequencing of specific natural or social phenomena at some or great spatial remove. These emerge with particular clarity in the explicit interregional comparisons provided by Huhtamaa and Labbé, while left more tacit or inchoate in Li's work on China, Preisler-Kapeller and Mitsiou on Byzantium, and the two contributions treating the Kingdom of Hungary. Could greater editorial intervention have yielded more definitive engagements with the problem of teleconnection? Some difficulties with retrospective comparison across the entire collection may be attributed to the huge differences in scale between working on China, the Nordic lands (Halonen), and even the Carpathian Basin or southern Balkans as compared to Bresse or Florence. Taken together, though, as highlighted by the organizers and editors of this collective effort, these findings call for investigation of systemic linkages (socio-cultural or natural) and offering hypotheses of larger-scale systems, periodicity, or processual paradigms (perhaps resembling global circulation models or Victor Lieberman's 'Strange Parallels'[2] as raised in the introduction).

---

1 As does Martin Bauch, Jammer und Not. Karl IV. und die natürlichen Rahmenbedingungen des 14. Jahrhunderts, in: Český časopis historický 115/4 (2017), pp. 983–1011. Note, too, Schuh's explanation in this volume for the absence of weather information in reports by English manorial reeves on the crop failures of 1315–17.

2 Victor Lieberman, Strange Parallels. Southeast Asia in Global Context,c. 800–1830. Vol. I: Integration of the Mainland, Cambridge 2003. Vol. II: Mainland Mirrors: Europe, Japan, China, South Asia, and the Islands, Cambridge 2009), initially vol. 1, pp. 85–110, and most broadly in vol. 2, pp. 49–270.

Even without substantive linkages what we here provisionally call 'teleconnections' remind a reader that history is not one seamless or central story but that much was and is going on simultaneously and being shaped by unique interplay of the local with multi-layered forces. Nothing in this collection is a true microhistory, but given serendipitous sources and a bold research design, one could imagine a Venetian merchant travelling the silk route a generation or two after Marco Polo to experience both the devastating flood that changed the course of the lower Yellow River in 1344 and the central Asian drought now thought instrumental in projecting the plague bacillus, *Yersina pesti*, into the Pontic steppe and thence western Europe. He could not have known the latter connection but back in his lagoon in 1348 he'd have felt, as did Petrarch, the shock of the Friuli earth shaking on January 25. The latter event killed some ten thousand and reshaped regional trade routes; the catastrophe on the Yellow set in motion the fall of the Yuan dynasty; and the Black Death eliminated a third to a half of Europeans and cleared the ground for what Bruce Campbell calls 'the Great Transition.' In this volume Schreg argues that human transformation of central European landscapes helped make those high mortalities possible. Some years later, Brown tells us almost in passing, the great windstorm that knocked buildings down upon people in England on 15 January 1362, followed a now-predictable track to drown some 20–25,000 in the *Grote Mantranke* flood of 16 January along recently drained and diked Saxon and Frisian coasts of the North Sea. Climate models now would explain the latter linkage; historical epidemiology may be helping grasp the Black Death and later plague epidemics but so far neglects other patterns of disease morbidity and mortality; and earthquakes close in time in China, in Italy, and (though not mentioned here) in Catalonia and Portugal lack comparable connective theory. So the teleconnections themselves, once recognized, elicit some potential oscillation between emic reimaginings and etic analyses.

As presently used, 'teleconnections' refers to synchrony but then at a second level they include possible lags. Whether they are to be expected or not may depend on what you already know. The term originated in late 19th century observations of weather and climate anomalies related to one another at large distances. Sets of these correlated, so the fluctuations were not random coincidence. Subsequent work in atmospheric and oceanic sciences worked out models and explanations, some involving stationery waves along which pressure systems move, others the patterns of zonal circulation. In both forms circulation takes time, so, for instance, sea surface temperatures in the central Pacific can serve to predict precipitation patterns in eastern North America weeks or months in advance. Hence 'true' teleconnections are not just correlation but not necessarily cause-effect either. All elements in some sets may derive independently from a more basic force or condition and so themselves be proxy indicators of an underlying driver. The 1362 storm pertains to a certain path of the North Atlantic Oscillation but wind in interior England hurt only people unlucky enough to be near unstable structures, while wind and tide from certain directions drives the North Sea on to coasts of the German Bight where human societies had

replaced thinly inhabited marshes with dense agricultural settlements. In geological terms the storm was everywhere a catastrophe (a sudden and violent event), but prior human actions made it a disaster.

Repeated contingency chains may extend well beyond climate to teleconnect biological and cultural phenomena. For example, mercury concentrations in 2000 years of datable remains of southern elephant seals (*Mirounga leonina*) from bottom cores in an Antarctic lake fluctuate by up to 25 percent above or below the long term mean, peaking during centuries when Mayans and Tang dynasty Chinese were mining much gold and silver (ca.750–900), during times of high silver extraction in medieval Europe and the Andes (ca1200–1500), and again when Spain took vast quantities of precious metals from Mexico and Peru (1650–1800). Intervening low mercury levels coincided with the collapse of Rome and Han China, civil strife in Mesoamerica and China, and the initial Spanish conquests in the Americas, all of which curtailed mining activity. Joining these apparently and widely separate phenomena was global circulation of methyl mercury from refining processes in Asia, Europe, and the Americas to surface sea water of the far Southern Ocean and bioaccumulation in the squid, fish, and krill consumed by seals and penguin species.[3] Close historical reading would, however, note the lags between curves of mining activity and contamination in the seals. Transport and bioaccumulation of pollutants at locations far from their emission are slow to take effect and so, too, the lowering of levels after production fell.

Without going deeply into the literature, it seems for now that Victor Lieberman brought the concept of teleconnection into historical scholarship in the first 21st century decade. His *Strange Parallels*, however, works not only with some fairly general notions about medieval climate regimes but also with correlations across parallel stages of state formation. Benign medieval weather patterns at both ends of Eurasia, though differently beneficial to distinctive local agroecosystems, let certain socio-political communities emerge. Mechanisms, however, remain unclear. Teleconnections gained more explanatory power in Campbell's *Great Transition*, which, working at the smaller scale of Latin Christendom ca1250–1450, relies more explicitly on climate-biology-economy linkages and repeatedly leaves room for contingent human responses to resulting conditions. Campbell may further be responsible for introducing systemic lags into his explanatory system.

In some respects the papers in the present collection may be thought an initial research response to the Campbell synthesis. Other than their shared engagement with interlocking narratives of key events in the 14th century, contributions range from explicit to tacit attention to temporally-related anomalies in environmental and economic conditions across Europe (or even Eurasia) to those which ignore the

3 Liguang Sun et al., A 2000-year record of mercury and ancient civilisations in seal hairs from King George Island, West Antarctica, in: Science of the Total Environment 368 (2006), pp. 236–247. Cores with much seal dung or penguin excrement show similar patterns.

teleconnection paradigm entirely for other ways to relate human engagement with natural phenomena. Among the latter Halonen may be the most unorthodox in trying to document what appear to be shifts in how Italian and Nordic writers saw, defined, and dated the start of seasons, an important reminder that seasonality is in practice more a matter of biology and cultural activity than astronomy.[4] In a very different way Preisler-Kapeller and Mitsiou provide a thorough overview of the *status questionis* regarding climate and culture in the disintegration of the Byzantine empire. While exhibiting great care to avoid simple causal connections from climate change to politics, their paper may also demonstrate the difficulty of arguing complex interactions in a situation of sparse information both environmental and socio-economic. There remains a great difference in scale between highly localized palaeoscientific records and the fragmentation of a society and polity.

The task of identifying potential teleconnections demands in the first place precision respecting time and place, each appropriate to the scale of the event. Contributors to this volume draw on a compelling diversity of sources and acknowledge that all need *critical* assessment and use. Control of medieval dating practices and toponomy are but a first step, followed by considering the rhetoric and purpose of the writer (or present-day palaeoscientist). The purpose is always to recognize the limits to what may reasonably be inferred from any well-considered source materials. Schuh provides in this volume an especially plain example of necessarily close reading in remarking the difference in the Winchester Pipe Rolls between clear documentation of flooding because it affected returns from specific meadows and pastures while manorial officials had no need to document widespread weather-induced declines in cereal yields.[5] At a different level of enquiry, researchers must remember not to conflate evidence of a plausible effect (e.g. food shortages) with evidence of particular potentially causal conditions (e.g. weather or 'climate change'). Nanni's argument that market conditions, not weather, brought about most episodes of cereal price inflation in 14th century Florence is an important reminder of this critical distinction, namely that circular reasoning must be avoided.

Once an event, experience, or trend is identified, context becomes essential. Are the observed conditions normal or anomalous in surrounding territories and/or decades? Li asserts that the repeated catastrophes of late 13th-early 14th century China were plainly unusual and the richness of documentation convinces. We could, on the

4 The Halonen paper deserves emulation by examining calendars from Britain, France, Spain, and the Empire, which will allow better judgement of any possible patterns. As Halonen rightly points out in this volume by the end of the Middle Ages defects in the Julian calendar make seasonal dates deviate by more than a week from the Gregorian calendar now in use. Assessing the date of natural seasonal phenomena (phenology) must take this discrepancy into account.

5 A highly relevant review and critique of long-term plague data sets and their digital access appears as Joris Roosen/ Daniel R. Curtis, Dangers of Noncritical Use of Historical Plague Data, in: Emerging Infectious Diseases 24/1 (2018), pp. 103–110.

other hand, assess patterns in winter severity in central Europe had we records of river ice at sites on the Rhine, Elbe, and upper Danube, but cannot usefully do so from but occasional mentions in narrative sources. Clear identification of the potentially linked phenomena needs to precede assertion of the connection. As well-illustrated in the contributions, potentially linked phenomena range widely:

- Material or physical records start with weather (temperatures, precipitation, wind) and its effects (floods, droughts, material damage), but can also catalog medium-term consequences of tectonic or volcanic events.[6]
- Biological phenomena such as biomass production (wood, wine, grain, animals domestic or wild), seasonality, habitat, and range often lag due to the periodicity of reproduction and growth as well as differential susceptibility of the life stages.[7]
- Cultural (human) fluctuations can be material, i.e. aspects of economic life writ large (prices, tolls, rent receipts, building constructions) or symbolic, the latter commonly separated in medieval Europe between 'high' intellectual or artistic activities and those of 'popular' culture. Labbé documents contemporary awareness of a close connection between weather events and economic facts at the local level in Bresse, with social consequences emerging only in subsequent years.

Scale inevitably matters. The geological time wherein tectonic and volcanic events may be teleconnected dwarfs the temporality of human victims. Historians have become habituated to telling climatologists that what matters at planetary or hemispheric scale may not be all that important in Bresse, or vice versa. Whereas violent weather (or human conflict) is always damaging, there is no *a priori* 'bad' or even 'deteriorating' climate; assessment depends on local/regional conditions, expectations, and adaptations. This makes the search for local environmental events and their impacts undertaken by Kiss, by Vadas, and by Camenisch critical to understanding socio-cultural responses. At levels of both sources and interpretation interdisciplinary knowledge is essential, exploiting different approaches to the same complex past. But when even the best preserved source-based data fails, wise scholars submit to the proverbial Scottish verdict, 'not proven'. Should one want to hypothesize – the

6 The latter can lag or be intermittent for three to ten years; clusters of eruptions amplify and extend these effects. See Richard B. Stothers, Climatic and demographic consequences of the massive volcanic eruption of 1258, in: Climatic Change 45/2 (2000), pp. 361–374, here p. 370; Clive Oppenheimer, Eruptions that Shook the World, Cambridge 2011, pp. 53–76, 260–267 on the 'pulse' of volcanism in the second half of the 13th century; Michael Sigl et al., The history of volcanic eruptions since Roman times, in: PAGES Magazine 23/2 (2015), pp. 48–49.

7 It takes two to three consecutive years of favourable conditions for successful locust reproduction to become dense and produce migratory swarms. After a cold spring in the North Sea causes failure of that year's class of herring (*Clupea harengus*) larvae, three to five years later the missing mature fish result in low catches. An interval two or more times longer than the herring is needed to rebuild herds of draft oxen killed by rinderpest.

'unexpected connection' – readers reasonably anticipate reference to the kinds of information, now lacking, needed to test the hypothesis.

If 'teleconnections' are a new interpretive idea and, given appropriate operational definitions, can highlight potentially demonstrable sets of empirical 'facts' to be explained, 'crisis' has arguably become shopworn in historical discourse. This is no venue to reiterate philosophical critiques of the concept[8] other than to point out recent decades' debasement of the word's meaning to the level of 'a bad situation.' Identifying in putative crises a critical phase, tipping point, loss of confidence, and eventual historically immanent transition – or lack of same – may be useful for large comparative purposes, but in any given historical situation helps little to identify key variables, drivers, and consequences.

How is 'crisis' used? How, in particular, does a researcher decide if s/he had a 'crisis' in order then to discuss causes, effects, responses, or the like? Is it a crisis if visible only in historical retrospect? Or ought this diagnosis be treated as an emic proposition determined by what people in the past felt/said they were experiencing?

Contributors to this book are quite circumspect. Several (Li, Schreg, Schuh) speak instead of 'disasters', vulnerability, or environmental impacts. More seem to think of specific episodes. In chronological sequence Labbé finds the crop failures of 1315–22 to be a crisis which resulted in a 'depression'; Nanni shows Florence to be subject to 'general crises [plural *sic*] in food supply' which accumulated as repeated local famines; Kiss has bad harvests and food shortages producing 'multi-year crises' in lands of the Hungarian crown; while Brown sees the 1362 storm as a 'short term crisis.' Huhtamaa has the most elaborated process with weather plus warfare plus the Black Death pushing western Europe to a tipping point for a 'pan-regional crisis' to which the different social ecology of the northeast was largely immune. The larger scale is also where Preisler-Kapeller/ Mitsiou approach the 'fatal Byzantine crisis' of early 14th century politics and Camenisch locates the confluence of socio-economic, politico-cultural, and demographic crises in the west. Readers with methodological propensities will want to puzzle over the investigative or other role this concept best serves in confronting the indubitable shocks, disruptions, and destruction many 14th century Europeans suffered, endured, or overcame. Insofar as these experiences and outcomes did extend across large territories, are they

8 See Richard C. Hoffmann, An Environmental History of Medieval Europe, Cambridge 2014, pp. 345–347, and more analytically J. B. Shank, Crisis: A Useful Category of Post-Social Scientific Historical Analysis?, in: American Historical Review 113 (2008), pp. 1090–1099. A.T. Brown/ Andy Burn/ Rob Doherty, Coping with Crisis: Understanding the Role of Crises in Economic and Social History, in: Brown/ Burn/ Doherty (eds.), Crises in Economic and Social History: A Comparative Perspective, Rochester 2015, pp. 13–14, are more comfortable with ambiguity. Less attentive to epistemology as such are Daniel R. Curtis, Coping with Crisis. The Resilience and Vulnerability of Pre-Industrial Settlements, Farnham 2014, and contributors to John Drendel (ed.), Crisis in the Later Middle Ages: Beyond the Postan-Duby Paradigm (The Medieval Countryside 13), Turnhout 2015.

now creatively grasped as teleconnections manifesting a deeper systemic malaise or as diverse societies confronting comparable local problems of perhaps mainly climatic origin?

Historical research and interpretation can start from the event, in this case commonly a natural occurrence or change of trend, and seek to learn its consequences or from certain socio-cultural phenomena and work back to their preconditions and triggers. Both approaches have their risks, the first an inclination toward fallacious *post hoc, propter hoc* reasoning and the second to failure of imagination or mindless adherence to the doctrine of social phenomena arising from social causes. Can teleconnections do more than confirm that a lot is going on at the same time and become a tool for understanding long-range relationships? Contributions here offer the germ of some ideas for interactions but not yet a shared sense of what is being sought or what purpose or use it might serve. Has simultaneity itself any significance? What more can it reveal about European and Eurasian antecedents to the Great Transition? Gaps in the coverage of essays in this book suggest testing these propositions on local and regional data from the Low Countries, Iberian peninsula, and heartlands of the medieval French kingdom. Weather patterns (day to day climate on the ground) seem less well known for medieval Mediterranean Europe. What strange parallels may link Castile, Naples, and peninsular and archipelagic Greece in, for instance, the transition to the Little Ice Age?[9]

9 Surely it is time to activate the static natural stage setting for human actors constructed in Fernand Braudel's The Mediterranean and Mediterranean World in the Age of Philip II, transl. Siân Reynolds, 2 vols. New York 1972), vol. 1, pp. 25–102, 231–275, and even in Peregrine Horden/ Nicholas Purcell, The Corrupting Sea. A Study of Mediterranean History, Oxford 2000, who rather elide the millennium from late antiquity to the high Renaissance. A. T. Grove/ Oliver Rackham, The Nature of Mediterranean Europe. An Ecological History, New Haven 2001 may point the way.

Index of Places

The indices list historical and fictitious names of persons, groups and institutions and places, geographical and political units mentioned in the main text of the contributions. Mentions in the annotations were only included in the most relevant cases. Titles of works with know authorship are not listed separately, but can be found by the name of the author.

Aa river [Limmat] 56
Abaúj county 113
Abbey of Strata Florida, Ceredigon, Wales 30
Abruzzo 176, 177
Acre 212
Adderburry 253
Adrianople/Edirne 216
Adriatic Sea 57, 175
Aegean 199, 202, 214, 215
Africa 221
Afro-Eurasia 191, 215
Akasztó 277
Albania 199, 201, 213
Alemanie 55
Aletsch Glacier 46, 176
Alexandria 211
Alpine area(s) 47, 54
Alpine glaciers 176
Alpine parts of Austria 52
Alps 46, 175, 214, 242, 268
Alsace 114, 137
Alsacie 53
Alsatia 53
Amadi 212
Americas 284
Anatolia 197, 203, 205, 210, 215
Anchialos 214
Andes 283
Angkor 19
Anglia 27
Antarctic 283
Antioch 203
Apennines 175, 177
Arctic 35, 96
Arezzo 178, 179
Arno Valley 25, 178, 182
Artic 97
Ascoli 178
Asia 20, 57, 284
Asia Minor 190, 197, 203–205, 208–212, 215, 218, 219
Athos 215, 218, 219
Atlantic 242
Augsburg 59
Austria 102, 109–111, 113, 115–117, 121, 122, 124, 127, 128, 269, 277
Avignon 2, 44, 58
Azores 96

Bábaszék 114, 120
Babiná 114, 120
Baimao (白茅) dike 166
Balatonszőlős 272
Balkans 190, 197, 204, 213, 214, 282
Baltic 52
Baltic Sea 89, 92
Baranya county 113, 119, 126
Basel, Switzerland 2, 42, 49, 50, 53, 56, 59
Basin 118
Battle Abbey 255
Bavaria 113, 120, 122, 127, 230, 242
Beijing 158
Békés County 278
Belfast 21
Belfry at the Augustinian friary of Clare, Suffolk 37
Benedictine Abbey of St Albans 27
Benedictine Abbey of St John, Colchester, Essex 38
Bergamo 178
Berkhamsted, Hertfordshire 40
Berkshire 250
Bern 50, 51, 53, 58
Béthune 148
Biblioteca Angelica 65
Biblioteca Apostolica Vaticana 65
Bithynia 197, 205–207, 211, 213
Bitzina 214
Black Forest 223, 225, 226, 239, 242
Black Sea 214, 244
Black Vlach (Morlach) 123
Bohemia 4, 263, 273

Open Access. © 2020 Martin Bauch & Gerrit Jasper Schenk, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

https://doi.org/10.1515/9783110660784-015

Bohemian Forest 223
Bologna 178, 181, 184
Bolton Priory 256
Borsmonostor 123
Bourg-en-Bresse 131
Bratislava 114, 120, 124, 127
Breisach 56
Bresse 130, 134, 140, 145–151, 282, 286
Bristol 259
Britain 25, 284
British Isles 23, 25, 33, 52, 79, 89, 244, 264
Bruck 127
Bruges 148
Buda 114, 120, 127, 274
Budafelhéviz 114, 119
Budapest 114, 119, 274
Bulgaria 197, 203, 204
Bunte Moor 176
Burma 19, 165
Bursa 215
Bury St Edmunds, Suffolk 27
Byzantine Anatolia 196
Byzantine Empire 190, 192, 199, 209, 212, 217, 220, 284
Byzantium 190–192, 194, 195, 209, 211, 212, 215–217, 281, 282

Calderone glacier 176
Cambodia 19
Cambridgeshire 150
Canterbury 36, 37
Canton Valais 46
Cappadocia 203
Carinthia 121
Carpathian Basin 109–111, 118, 124, 263–270, 273, 277–279, 282
Casentino 180
Castile 288
Catalonia 283
Cathedral church of Holy Trinity, Norwich 38
Cathedral, County Cork 38
Čenčice in Slovakia 113
Center of France 139
Central Asia 15, 195
Central China 154, 166, 167
Central Europe 45, 79, 100, 109, 116, 118, 123, 125, 221, 222, 230, 234, 238, 240–244, 246, 263, 264, 267, 269, 273, 285
Central Finland 92
Central Greece 207
Central Hungary 118
Central Italy 69, 74, 171
Central Sweden 88
Central Transdanubia 115
Ceyzeriat 149, 150
Chambery 136, 147
Chanta 113, 114
Cheşereu in Romania 114, 115
China 21, 153–156, 158, 161, 165, 167, 195, 281–283, 285
Churches of Stone, Kent 38
Church of St Mary's, Ashwell 42
Clarendon, Wiltshire 28
Cloyne 38
Colmar 53, 61
Cologne 128
Constantinople 57, 190, 203, 208–210, 213–220
Continental Europe 25, 48
Cornwall 32
Coron 215
Crete 215
Crimea 213, 215
Croatia 36
Croatian kingdoms 101, 122
Culham 253
Cyprus 203, 215
Czech lands 109, 110, 111, 113, 115–117, 120–122, 125, 127
Czech Republic 4

Dadu 158
Dai Viet 19
Dalmatia 102, 112, 114, 122, 123
Damascus 215
Danish coasts 26
Danube 54, 55, 125, 242, 265, 266, 274, 276, 285
Danube Bend 274
Danube-Tisza Interfluve 277
Darmstadt 21, 22
Dauphiné 134
Debrecen 117
Dej 114
Denmark 25, 26, 66
Despotate of Epirus 204
Despotate of Morea 216
Dés(vár) 114

Devon 32
Dobrá Niva 114, 120
Dobronya 114, 120
Downtown 253
Dráva River 276
Drymosyrta 219
Dublin 27
Dubrovnik 122
Dunstable 38
Earth 11
East Asia 90, 156
East central Europe 111, 114, 115, 128, 264, 268
East coast 27
East England 255
Eastern Asia 195
Eastern Europe 22, 79, 193, 269
Eastern Mediterranean 196
Egypt 193, 211–213, 215
Elbe 225, 242, 285
Eleutheroi 219
Emilia 179
Empire of Nicaea 204–205
Empire of Trebizond 204
Engadine 47
England 2, 23–25, 26, 32, 35, 36, 39, 44, 48, 81, 116, 127, 130, 131, 148, 150, 155, 193, 194, 229, 244, 247–249, 254, 256, 258, 260, 261, 283
Epirus 213
(Ér)Keserű 115
Escaut 137
Esher 255
Essex 34
Esztergom 114, 127
Euboia 215
Eurasia 19, 96, 244, 280, 284
Eurasian steppe 155
Europe 2, 5, 15, 19–21, 35, 43, 52, 54, 57, 59, 60, 60, 81, 89, 95–96, 98, 111, 113, 116, 118, 124, 125, 128, 129, 132, 169, 171, 191, 195, 199, 203, 208, 209, 212–215, 220, 221, 231, 243, 250, 254, 264, 280, 283, 284, 286, 288

Far East 221
Far eastern Baltic 89
Finland 66, 68, 78, 81, 82, 91–94, 96, 269
Finnish National Library 64
Flanders 140, 148
Florence 2, 25, 169, 174, 178–187, 214, 282, 285, 287
France 2, 52, 116, 120, 125, 127, 130, 132, 227, 230, 244, 264, 279, 284
Franconia 243
Fraumünster church 56
Fribourg 60
Friuli 282
Frǒwenmúnster 56
Fujian 161

Gabčíkovo–Nagymaros Dams 274
Gaia 11, 12
Galata 214
Gallipoli 213, 219
Gatehouse at St Albans 40
Gelnica 271
Geneva 53, 61
Genoa 178, 209
German Bight 283
German empire 114, 273
German lands 4, 26, 55, 57, 59, 116, 120, 124, 125, 127
Germany 26, 221, 224, 226, 230, 240, 242
Golden Horde areas 111
Gomatou (Iberon) 219
Gomatou (Laura) 219
Gorner Glacier 46, 176
Grand Canal 164, 167
Gran Sasso 176
Great Britain 38
Great Canal 164
Great Heney, Essex 38
Great Hungarian Plain 110, 114, 115, 278
Great Wall area 157, 158, 160
Greece 197, 204, 206, 207, 212, 288
Greenland 195
Gulf of Finland 81

Hangzhou 163
Hard 225
Hardturm 56
Harz 223
Hebei area 162, 167
Heidelberg 21
Helin 158
Hertfordshire 27, 149
Hierissos (Iberon) 219
Himalayas 16

Holy Roman Empire 44, 52, 57, 284
Holzminden 243
Huai River 161, 167
Huguang 164
Hungary 54, 100–103, 107–113, 115–128, 263–267, 269, 274, 277–279, 282
Iberian peninsula 288
Iceland 66, 70, 96
India 221
Indian 16
Indonesia 157, 208
Ireland 25, 26, 38, 260
Istria 117
Italy 5, 21, 118, 120, 169–171, 174–181, 184, 187, 189, 283

Ják 114
Japan 156
Jasseron 130, 131, 134, 135, 136–142, 144–147, 149–151
Jena 197, 215
Jiangxi 164
Jiangzhe 163, 164
Jutland 228

Kaffa 214
Kalmar Union 66
Kapronca 114, 120
Karelia 82, 92, 94, 95
Kato Bolbos 219
Kent 34
Kephallonia 214
Keserű 114
Kiev 19
King's Langley, Hertfordshire 39
Kiskunhalas 277
Kiskunság region 277
Kis-('Small') Balaton 276
Klagenfurt 12
Kleinhard 225
Klostermarienberg 114, 123
Koprivnica 114, 120
Korea 155–156
Korone 215
Kőszeg 120
Kraina 117

Ladoga 82, 93
Lake Bafa 205
Lake Balaton 124, 266, 276, 277
Lake Constance 55
Lake Fertő 265, 266, 277
Lake Fucino 177
Lake Mezzano 177
Lake Oeschinen 47, 56, 60
Lake Silvaplana 47
Lake Torneträsk in Sweden 77
Lake Vico 177
Lake Zurich 59
Lands of Canterbury 40
Lapis Refugium 114
Latros 205
Laufenburg 56
Lazio 65, 177
Leipzig 21, 22
Lembos 205
Lemnos 215
Letanovce 114
Levant 217
Levoča 271
Lindau 49
Livonia 91, 93
Lombardy 44, 54, 55, 179, 184
London 27, 32, 148, 260
Longstanton, Cambridgeshire 28
Long Wittenham, Oxfordshire 32
Loroton 219
Lotharingia/Lorraine 53, 114
Low Countries 26, 125, 288
Lower Austria 225
Lower Lusatia 225
Lower Saxony 243
Lucca 178, 181, 182, 184
Lucerne 51, 55
Lund 66
Lyfflandt 91
Lyon 131, 139

Macedonia 197, 208, 209, 211–213, 215, 218–220
Mainz 128
Majella summit 176
Makrinitissa Monastery 211
Marche 178, 184
Marchegg 127
Margaret Island 114, 274, 275
Máriahegy 114
Markgräflerland region 50
Marmara 219

Maros (Mureş-Ro) river 121
Marseilles 57, 58
Maurokastron 214
Mediterranean 89, 133, 148, 175, 177, 190, 195, 197, 199, 203, 213–215, 242, 288
Melitziane 219
Menedékkő 114
Mengen im Breisgau 228
Mesoamerica 283
Mesopotamia 208
Messina 58
Methone 215
Mexico 283
Milan 178
Miletus 205, 210
Mistras 217
Modena 178, 181
Modon 215
Moldava nad Bodvou in Slovakia 114, 120
Mongolian steppe 153, 157, 160, 161, 164, 167
Mosabur 276
Mosel 60
Mount Athos 191
Mount Qilian 156, 157
Mugello 180

Nagymaros 274
Nagy-Sár 277
Nanjing 162
Naples 184, 288
Near East 196, 203, 204, 222
Negroponte 215
Neisse 225
Németpelsőc 114, 120
Netherlands 228
N-Fen 88
Nicaea 208
Nicaean Empire 206
Nidaros 66
Niederdorf 57
Niederlausitz 225
Nitra 113
Nordic countries 62, 66, 68, 75, 282
Nordic region 70
Norfolk 27, 34, 150
Normandy 140
North America 283
North Atlantic 36, 89
North-central China 162
Northeastern Europe 22, 80, 81, 82, 85, 88, 90, 92, 96, 98, 99, 268, 269, 281
Northern China 155–157, 160–161, 164
Northern Europe 19, 180
Northern Fennoscandia 83
Northern Finland 84, 92
Northern France 25, 35, 44, 148
Northern Italy 109–111, 117, 118, 124, 125, 171
(Northern) Macedonia 215
Northern Russia 89
Northern Scandinavia 88, 90
Northern Vietnam 161
North of Hungary 118
North Sea 2, 27, 228, 283, 286
Northwestern China 156, 160
Northwestern Europe 89, 141
North-western Germany 25
North-West Russia 81
Norway 66
Norwich 27, 35, 255
Norwich Cathedral 28, 29, 38, 42
Novgorod 82, 83, 85–87, 90–91, 93–96, 98

Oberwürzbach 225, 242
Óbuda 274
Oder 242
Odoorn 228
Ópusztaszer 278
Ore Mountains 223
Orsanmichele market 183
Orvieto 178
Oslo 21
Oxford 39, 260

Pacific Ocean 161, 283
Padua 55
Pagan 19
Palatinate 53
Palatinate Forest 222, 226
Papal States 178
Pápóc provosts 114, 125
Paris 35, 137–140, 145
Parma 178, 181
Patmos 205
Peloponnese 203, 215–217
Pera 214
Persia 111
Peru 283
Perugia 178, 182, 184

Pest 274
Petenye 113, 114
Picardie 227
Pilis 114, 121
Pillingbere 253
Pinson 219
Pisa 178, 181, 186
Pistoia 170, 181, 182, 184
Plešivec 114, 120
Plymouth 34
Poland 111, 117, 120, 263, 269, 273
Polar region 96
Polar Siberia 83, 88, 90
Pont d'Ain 130, 131, 135, 136–140, 144–145
Pont-de-Vaux 130, 131, 136, 137–141, 145
Pontic steppe 282
Pontus 197
Po River 177
Portchester Castle, Hampshire 30
Portugal 283
Po Valley 178
Pozsony/Pressburg 114, 119, 124, 127
Prešov 271
Princeton 199
Providence 184
Pskov 82, 91, 92
Puglia 181, 184
Puy-de-Dôme 222
Pyrenees 214

Rábaköz region 116
Rabbit Island 113, 114, 126
Ragusa 122
Reuss river 55
Rhaidestos 214
Rheinfelden 56
Rhine 56, 60, 125, 228, 229, 242, 285
Rhineland 240
Rhodes 212, 215
Rochester Castle, Kent 30
Romagna 178, 180, 183
Roman Empire 63
Rome 21, 65, 67, 69, 70, 73, 75, 77, 184, 283
Rome, *Institutum Romanum Finlandiae* 65
Rozgony 117
Rúsa 55
Rus' principalities 98
Russia 82, 89, 111

Saarland 53
Säckingen 56
St. Albans 28, 256, 258
St. Augustine's Abbey in Canterbury, Kent 27
St. Mary's Church, Ashwell, Hertfordshire 30, 31, 41
St. Pancras 27
St. Patrick's Cathedral, Dublin 31
St. Peter and St Mary in Stowmarket, Suffolk 31
Sălaj 272
Salisbury Cathedral 40
Samalas volcano (Lombok) 157, 208, 210
Samaria 261
Sámi 95
Šamorín 124
Sanciacum 150
Sangarios river 210, 218
Sarine 60
Savoy 22, 130–131, 134, 136, 144, 145, 152
Saxons 120
Scandinavia 52, 67, 69, 78, 79, 89, 96, 240, 279
Schaffhausen 49
Sclavonia 112
Scotland 256, 260
Selymbria 217
Serbia 216
S-Fin 88
Shandong province 166, 167
Sicily 57, 58, 181, 212
Siena 178, 179, 182, 184–186
Silesia 122, 127
Siófok 277
Sivas 215
Slavonia 102
Slovakia 35, 120, 270
Solling 223, 243
Somorja 124
Sopron 113, 120
Southampton 35
South China Sea 162
Southeast Asia 18–19, 156, 168
Southern China 155, 161, 162
Southern England 25, 35, 41, 42, 148, 256
Southern Europe 72, 79
Southern Finland 83, 84, 90, 91
Southern France 125
Southern Italy 178
South Wales 32
Southwest England 27

Southwestern Europe 94
Southwest Hungary 126
Sozopolis 214
Spain 222, 283, 284
Spessart 223
Speyer-Vogelgesang 228
Spiš region 114, 270, 272
Spišský Štiavni 271
State of Savoy 130
Stomion 219
Styria 117
Suffolk 34
Sweden 66, 82, 91, 96
Swiss Alps 45, 46
Swiss Plateau 52
Switzerland 22, 43, 44, 46, 48, 49, 51–54, 55, 60, 98, 264
Syria 203, 208, 210, 211, 213
Szepes county 113, 118
Szepesség 114
Szepsi 114, 120
Szer 278
Szőlős 114, 272

Talamone 186
Tecer Lake 203
Thaxted, Essex 28
Thessaloniki 209, 215, 217, 220
Thessaly 211–213, 218
Thrace 203, 208, 209, 212, 218–220
Tihany 114, 126, 272
Tisza 126, 265, 278
Torpel, Northamptonshire 38
Tournai 138, 139
Tours 138
Transdanubia 272, 276
Transylvania 110, 120
Trau 122
Treffort 130, 131, 134, 136–140, 142, 144–147, 149–151
Trogir 122, 123
Turkey 197, 199, 200, 203
Tuscany 174, 178, 179, 180–182, 184
Tyrrhenian Seas 57, 175
Tzympe 213

Újváros 274
Umbria 178
Uppsala 66

Vác 274
Valais 47
Vasvár 114, 122
Veliky Novgorod 82
Venetian lagoon 176
Venice 178, 183, 209
Veszprém 114, 115
(Veszprém)Szőlős 115
Vienna 12, 14, 122, 220
Vietnam 155, 156
Visegrád 274
Vltava 125
Vorbasse 228
Vosges 222, 226

Waldviertel 225
Wales 256, 259
Walloons 120
Waltham St. Lawrence 250, 252, 253
Wenzhou area 161
Weregrave 253
Weser Mountains 243
Western China 156
Western Europe 19, 45, 80, 83, 88, 89, 91, 92, 94, 98–101, 116, 118, 123, 145, 191, 194, 267, 282, 287
Western Hungary 115–118, 122, 125
Westerrich 53
West Germany 4
Westrich 53
Whitechapel, London 38
Winchester 22, 248, 249, 252, 254, 255, 261, 285
Winnefeld 243
Winterthur 55, 114
Wittney 253

Yaku Island 156
Yangtze delta 153, 154, 161, 163, 164, 166, 167
Yellow River 154, 156, 166, 167, 282
Yue areas 163

Zalavár 276
Zebegény 114, 119
Zeuleus 272
Zhe 161
Zhenjiang 161
Žilina in Slovakia 114, 116, 126
Zsolna 114, 116, 126
Zurich 49–51, 54–55, 59

Index of Names

Aba, Amadé 113
Abel, Wilhelm 3, 242
Ade, Guillelmus 211
Aegidius Tschudi of Glarus 51
Albini, Giuliana 179
Alexandre, Pierre 136–140
Alighieri, Dante 13
Andronikos II 210–212
Andronikos III 210, 213
Aquinas, Thomas 39
Augustinian Order 127

Bailey, Mark 191, 194
Bartholomew (saint) 64
Bauch, Martin 22, 220, 268, 273, 281
Baumeister, Martin 21
Beatrice of Savoy 131
Bede (Beda Venerabilis) 69, 70
Behringer, Wolfgang 89
Béla IV 120, 274, 275
Benedictine order 126
Bernoulli, August 51–52
Black Prince 28, 37, 39, 42
Boccaccio, Giovanni 13
Bois, Guy 193
Borsch, Stuart J. 193, 194
Boucheron, Patrick 18
Bourin, Monique 132
Bren, Llywelyn 259
Brenner, Robert 193, 194
Brook, Timothy 162, 168
Brown, Peter 10, 20, 22, 281, 283, 287
Buddha 162

Caesar, Gaius Julius 63
Camenisch, Chantal 20, 22, 281, 286, 287
Campbell, Bruce 21, 22, 44, 81, 96, 143, 148, 154, 155, 194, 208, 214, 215, 224, 283, 284
Camuffo, Dario 177
Carthausian order 113
Caspar Hain 113
Cassard, J.C. 132
Castracani, Castruccio 186
Charles I 272
Charles (Robert) 102, 117
Charpentier Ljungqvist, Fredrik 72, 75, 79
Cherubini, Giovanni 170
Cicero, Marcus Tullius 188
Cistercian order 123
Collet, Dominik 21
Confucianism 155, 158, 167
Cook, Edward R. 199
Counts of Savoy 144, 145
Csák, Máté 113

Dade reign 163, 164
Dante Alighieri 180
Dauphiné 134
Derville, Alain 132, 148
Diamond, Jared 189
Dittlinger, Heinrich 51
Dominican order 113, 126
Douglass, Andrew E. 81
Drendel, John 132
Duby, George 3
Durkheim, Émile 3
Dušan, Stefan 213

Earls of Savoy 130
Ebert, Stefan 140
Edward II 256, 259, 260
Eleanor of Provence 131
Emperor Wuzong 164
Engler, Steven 7
Esper, Jan 77
Estangüi Gómez, Raúl 213
Etterlin, Petermann 51, 59

Finzi Hart, Juliette A. 17
Fischer-Kowalski, Marina 12
Florentines 181, 184, 185
Fritts, Harold C. 81
Frőlich, Márton 271

Giraudi, Carlo 176
Glebe, Ellen Yutzy 21
Gómez, Raúl Estangüi 215
Graus, František 4
Grudd, Håkan 77
Gunderson, Lance H. 13

Hain, Caspar 111, 270, 271, 272
Haller, Wolfgang 49

Open Access. © 2020 Martin Bauch & Gerrit Jasper Schenk, published by De Gruyter. BY-NC-ND This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.
https://doi.org/10.1515/9783110660784-016

Halonen, Marko 22, 281, 282, 284
Han Chinese 154, 167
Hanseatic League 82
Harvey, Alan 193
Harvey, Paul 255
Hatcher, John 191, 194
He Fuqiang 154
Henry III 131
Hiekkanen, Markus 68
Hoeneke, Bartholomäus 91
Hoffmann, Richard C. 12, 22, 214
Holling, Crawford S. 13
Huhtamaa, Heli 10, 20, 22, 80, 281, 282, 287

Isaak II Angelos 204
Isidore of Seville 69
Islip 39
Istvánffy 271
Izdebski, Adam 6, 197, 210, 215

Ják monastery 116, 117
János 272
Johannes of Winterthur 49, 52, 54, 55, 58, 61
John III Dukas Vatatzes 204
John IV Laskaris 208
John VI Kantakuzenos 213, 217
John of Trokelowe 256–259, 261
Jones, Eric 20
Jordan, William C. 89, 104
Justinger, Conrad 50, 58, 59

Kates 173
Kershaw, Ian 148
Khan 159
Kiss, Andrea 20, 22, 100, 279, 281, 286, 287
Knighton, Henricus 26
Knoll, Martin 13
Krämer, Daniel 14
Kristó, Gyula 112
Kőszegi family 117
Kublai Khan 153, 155, 158, 161, 162, 164, 165
Küküllei, János 92, 104, 109, 128
Külüg Khan 164

Labbé, Thomas 10, 20, 22, 130, 186, 187, 281, 282
Labuhn, Inga 6
Laiou, Angeliki 191, 192, 205
Latour, Bruno 12
Le Goff, Jacques 171
Leib, Kilian 49
Lenzi, Domenico 169, 178, 179, 183–185
Le Roy Ladurie, Emmanuel 132, 180
Lieberman, Victor 18, 19, 168, 282, 284
Li Tana 20, 22, 153, 281, 282, 285, 287
Lorenzetti, Ambrogio 188
Louis I 102, 109, 122, 123
Louis the Bavarian 186
Louis the Great 104
Lovelock, James 11, 12
Lucas, Henry S. 89, 271
Luhmann, Niklas 11

Marchionne di Coppo Stefani 180, 181
Mc Cormick, Michael 6
Manuel I Komnenos 203
Margaret of Hungary (saint) 275, 276
Margulis, Lynn 11
Mary Magdalene (saint) 242
Mary of Anjou, Queen of Hungary 102, 106
Matthew Paris 133
Menant, François 132
Michael VIII Palaiologos 208, 209, 210
Ming dynasty 167, 168
Mitsiou, Ekaterini 20, 22, 281, 282, 284, 287
Mongols 100, 153, 155, 157, 159, 160, 164
Morrisson, Cécile 205
Moser, Susanne C. 17
Müller, Hans 56

Nanni, Paolo 20, 22, 281, 285, 287
Necipoğlu, Nevra 220
Newfield, Tim 6

Order of the Holy Spirit 119
Ortelius 271
Ostrogorsky, Georg 192

Pegolotti, Francesco Balducci 214
Pelagius, Alvarius 1
Petrarch/Petrarca, Francesco 282
Pfister, Christian 14, 46, 195
Pierre II 130, 131
Pinto, Giuliano 185, 186
Piti, Ferenc 100
Pliny the Elder 69
Polo, Marco 282

Pontifex maximus 63
Popdi, Peter 273
Pope Gregory XIII 63
Popović, Mihailo 215
Postan, Michael 3, 193, 249
Preiser-Kapeller, Johannes 20, 22, 281, 282, 284, 287

Racinet, Philippe 145
Raphael, Sarah Kate 217
Ráskai, Lea 275
Roger 'tiler' 39
Rosta, Szabolcs 277
Rudolf IV of Austria 122
Rudolf von Erlach 51
Rüssow, Balthasar 91

Saint Albans Abbey 133
Salimbene de Adam 179
Sámi people 92
Savy, Pierre 133
Schatzki, Theodore R. 13
Schedel, Hartmut 51
Schenk, Gerrit Jasper 22, 281
Schilling, Diebold 50, 51, 58–60
Schreg, Rainer 22, 281, 283, 287
Schreiner, Peter 192
Schuh, Maximilian 10, 22, 281, 282, 285, 287
Schumpeter, Joseph 217
Schuster, Peter 3, 194
Sebők, Ferenc 100
Sen, Amartya 133, 173
Sigismund 102
Simon Islip, Archbishop of Canterbury 39
Sivery, Gérard 133
Snow, Charles P. 5
Song dynasty 158
Sosigenes 63
Spengler, Oswald 223
Sperfogel, Konrád 271
Stephen V 275
Steward of Jasseron 141
Sui dynasty 154

Tarrit 34
Teiszler, Éva 100
Telelis, Ioannis G. 196
Teutonic Order 98
Theodore I Laskaris 204
Theodore II Laskaris 208
Thommaso de Vio 275
Thuróczy, János 109
Tibetan monks 162
Titow, Jan 249
Tohtu Khan 111
Torsello, Marino Sanudo 212
Toubert, Pierre 136
Touchan, Ramzi 203
Tschachtlan, Benedict 51, 54, 58, 59
Tschudi, Aegidius 51, 53, 57–59
Tuchman, Barbara 4
Tumür Khan 161
Tungusic peoples 162
Türk, Dániel 271

Vadas, András 20, 22, 281, 286
Varlik, Nükhet 215
Venetians 183
Villani, Giovanni 169, 179, 180–183, 185–188, 189
von Wartberge, Hermann 91
von Winterthur, Johann 114

Whewell, William 6
Whittow, Mark 193, 194
Winiwarter, Verena 12
Wittfogel, Karl August 20

Yesün-Temü 159
Yuan dynasty 153–156, 158, 159, 161, 162, 164, 165, 167, 168
Yuanzhen 161

Zhida 163
Zhu Yuanzhang 167, 168