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Peter Haßlacher (†), Marco Pütz, Gero Nischik, Christoph Knauf, Marius Mayer, Hubert Job

ALPINE OPEN SPACES IN SPATIAL PLANNING – A PLEA FOR GREATER CROSS-BORDER COOPERATION[1]

Contents

Abstract
Alpine open spaces are becoming noticeably scarcer. In the Alps, this applies to the inherently limited area of permanent settlement, which in the case of Tyrol covers only 11.8%. The population is growing in many of the valleys and with it the infrastructure it requires. However, the open spaces, situated at altitudes above the settlements, are also being successively broken up and exploited through technical facilities (e.g. cable cars, hydro-electric facilities) or increasingly intensive types of use (e.g. e-mountain bikes). The preservation of open spaces began in Bavaria as early as 1972 with the implementation of the Alpine Plan, which established spatial planning objectives. The Alpine Plan divided Bavaria's Alpine region into three zones of varying traffic intensity, a true legislative innovation. Zone C was intended for nature conservation, which was still in its infancy at that time, and also aimed to reduce natural Alpine hazards. Primarily, however, this planning initiative was related to the role of the landscape as a setting for recreation in open spaces, i.e. leisure and tourism activities in natural surroundings. Today, there are similar initiatives of varying success in South Tyrol (Italy), Austria and Switzerland. This paper aims to analyse, compare and describe these initiatives and to critically assess how they are formulated, how they work, and how they are implemented by planners. The focus is on comparing analyses of approaches for preserving open space for people (local residents and their traditional economic activities, but also visitors) and the natural heritage. Present-day regional and spatial planning practices related to Alpine open spaces in the German-speaking and Swiss Alpine regions are presented and critically evaluated and future options for harmonising approaches across the borders are discussed.

1 This article is an abridged version of: Job, H.; Mayer, H.; Haßlacher, P.; Nischik, G.; Knauf, C.; Pütz, M.; Essl, J.; Marlin, A.; Kopf, M.; Obkircher, S. (2017): Analyse, Bewertung und Sicherung alpiner Freiräume durch Raumordnung und räumliche Planung. Hannover. = Forschungsberichte der ARL 7.

Keywords
Alpine open spaces – GIS analysis – open space analysis – nature conservation – spatial planning – tourism

1 Introduction

Even in the 1970s Alpine open spaces were already subject to a generally high pressure to utilise resources (Krippendorf 1975); this is the case today more than ever. In the general discussion about open spaces, the focus of interest is often on the valleys, whose population has increased over the years throughout the Alps (Bätzing 2015). This article primarily considers the open spaces in outlying areas – in the Alpine context, regions at higher elevations than areas of permanent settlement. In terms of spatial planning, the focus is thus on the areas where territorial stipulations to conserve open spaces close to settlements, such as in green zones, corridors and belts, tend to cease. This does not mean, however, that Alpine open spaces are always associated with higher altitudes. Ideally they stretch approximately to the lower edge of the continuous forest belt on the lower valley slopes. On the one hand, this prevents such open spaces from being topologically fixed in the area of the high-altitude 'worthless lands' where there are fewer conflicts (Job/Fröhlich/Geiger et al. 2013; Bender/Roth/Job 2017; Mayer/Mose 2017). On the other hand, this spatial extension into lower altitudes also does justice to the spatio-structural interlinkages between the 'real' Alpine region and the valleys (e.g. by forestry and seasonal pasturing tracks), not least with reference to winter tourism and the ski resorts (Haßlacher 2007a). This should also allow for a better connectivity of habitats between the mountain forests, high pastures and the 'barren lands' of the high Alps (Schoßleitner 2016).

The research area on which this study is based is situated in the German-speaking and Swiss Alpine region. The analysis thus considers the respective areas covered by the Alpine Convention in Germany, Austria (the federal states of Salzburg, Tyrol and Vorarlberg), Switzerland and Italy (the autonomous province of Bolzano-South Tyrol). These regions of the Alps are among those that are most intensively used and developed for tourism (Mayer/Kraus/Job 2011: 34). Here tourism is often the leading economic sector, especially in the high altitude, peripheral and sparsely populated valleys (Berwert/Rütter/Müller 2002). In general, there is also significantly greater and more sustained population and land-use pressure there than in other Alpine areas (Bätzing 2015: 304 et seq.). The subject of preserving as yet undeveloped Alpine landscape areas and areas little impacted by infrastructural development as open spaces thus seems particularly relevant. Furthermore, there are much greater similarities in culture, language, history, tourism offerings and spatial planning regulations in the German-speaking Alpine region than in the Romanic and Slavic Alpine regions (Bätzing 2015: 60 et seq.; 304 et seq.).

The development contest (to create the largest contiguous ski resort) between municipalities, valleys, regions and states makes it urgently necessary for a con-structive discussion to be conducted across the Alpine region (Haßlacher 2016a: 9). In light of the worsening problems, spatial planning must regain its standing and significance in the Alpine states and take new approaches. A balance between utilisation and open

space must be agreed and adhered to by the various stakeholders active on various scales: from representatives of planning practice and planning science to non-governmental organisations and local residents. Associations such as the International Commission for the Protection of the Alps (CIPRA Germany 2016) call for a general international halt to the extensive expansion of ski resorts. This is much too short-sighted and runs counter to the largely development-friendly attitude of present-day policy. A better understanding of spatio-functional structures is required, based on levels of intensity of use. Greater safeguarding of open spaces through spatial planning is required to provide conservation areas for people and nature. A new Alpine spatial planning architecture that also clearly defines areas for use is required (Haßlacher 2016b; Mayer/Strubelt/Kraus et al. 2016).

This article aims to provide an overview of the methodical analyses and spatial planning strategies that can be used to identify and protect undeveloped, semi-natural Alpine landscape areas with little infrastructure as open spaces. The following chapters first provide a short overview of the term 'open space' and related terms and propose an independent, comprehensive definition of open spaces, which is then used in this study (Chapter 2). Next, two long-established instruments used to preserve open space in the Bavarian Alps and Tyrol are briefly described (Chapter 3) and the cross-border coordination of these instruments is assessed (Chapter 4). Attention then turns to four current analyses (in the areas of the federal state of Salzburg, Vorarlberg, South Tyrol and the Swiss Alps) of the preservation of open spaces that are not anchored in spatial planning regulations or spatially relevant planning (Chapter 5). The article concludes by discussing the spatial planning options for safeguarding Alpine open spaces in cross-border contexts (Chapter 6).

2 Open spaces

There are various traditional and newer ideas and strategies on open spaces. This is highlighted by diverse studies with different approaches, which also leads to differing terminology. Terms like semi-natural open spaces, open areas, white zones, Alpine quiet areas, quiet areas and protected zones are used. These differ in their objectives but are often used synonymously, or regional preferences emerge despite considerably differing definitions and delimitations (Baier/Erdmann/Holz et al. 2006: 386; Häpke 2012: 14). All of this must be taken into account if an overarching understanding and a generally applicable definition of open space in the Alpine context is to be developed.

The basic function of open space is the protection and guarantee of the natural foundations of human life (soil, water, climate, air, landscape, fauna and flora) and the functionality of the ecosystems (conservation and regeneration). This requires a certain amount of open space (Ritter 2005: 336). More specifically, open space can be divided into three functions (*BMVBS/BBR* [Federal Ministry of Transport, Construction and Urban Development/Federal Office for Building and Regional Planning] 2006: i): ecological (e.g. landscape, species, biotope and soil conservation), economic (e.g. agriculture and forestry) and social (e.g. flood protection, immission control, recreation and landscape appearance).

Increasing greenfield land take and its attendant loss of open space can lead to diverse negative consequences. Some examples include soil sealing, landscape fragmentation, habitat fragmentation (ecological consequences), and increased traffic volume or rising infrastructure costs (economic and social consequences) (Schiller/Siedentop 2005: 83 et seq.).

Open space and open space conservation were originally regional planning concepts that first emerged during the reorientation of spatial planning towards environmental policy around 1974 (Ritter 2005: 336). This was triggered by the problem of increasing greenfield land take (Ritter 2005: 341). Open space was thus an antonym to settlement and replaced the terms that were common up to that point: 'open and green areas' or 'green space' (Ritter 2005: 336; *DRL* [German Council for Land Stewardship] 2006: 7). This is, thus far, a negative definition; it seems more useful to describe the term in a positive sense. Planning protection was intended to focus on specific functions of natural or semi-natural land (Siedentop/Egermann 2009: 1).

In general, open space is understood to refer to all non-built-up areas (*BMVBS/BBR* 2006: i; *ARE* [Swiss Federal Office for Spatial Development]/*BWO* [Swiss Federal Office for Housing] 2014: 4). From a landscape ecology perspective, open space is viewed as that part of the landscape which is not affected by 'built development or linear infrastructure facilities resembling built development' (Baier/Erdmann/Holz et al. 2006: 11). That does not mean such areas are fully unused: they are not wilderness areas (Schmauck 2015: 16). However even the wild, semi-natural landscapes of the Alps are usually not completely free of indirect utilisation. So in this respect, there is definitely a certain overlap with the wilderness concept.

Of interest are semi-natural areas in the sense of predominantly (ecologically) sustainable uses (e.g. extensive agricultural areas, forests, moors, rivers and lakes, farm tracks, cycle paths, hiking trails, bridle paths and mountain paths), which are or may also be subject to interactions between natural and/or anthropogenic factors (cultural landscape) (Ritter 2005: 336; *BMVBS/BBR* 2006: i). They thus consist both of wilderness (nature almost untouched by humans) and cultural landscapes that have been subject to minimal transformation (*BMVBS/BBR* 2006: i). Open spaces within settlement structures (e.g. parks and gardens) are not relevant here.

In summary, the normative definition on which this work is based is as follows: open spaces include areas that are without buildings of any kind, that are not predominantly developed (piecemeal, linear or extensive infrastructure), that are potentially able to support vegetation, that are ideally free from traffic or reserved almost completely for non-motorised transport and are thus 'noise-free'. Non-structural (in the sense of engineered) infrastructure is not present or is very limited.

Excepted construction includes non-disruptive infrastructure such as sacred buildings, summit crosses, fountains, monuments and paths up to 2.5 m wide (e.g. forestry service roads and agricultural tracks). For the latter, the nature of their surface is important: unpaved surfaces are acceptable and sealed surfaces should be avoided (except on steep hairpin roads). 'Not predominantly developed' ideally means a semi-natural open space completely free of 'disruptive' infrastructure, or at least with only

a small proportion of disruptive infrastructure such that not more than 20% of the space is developed with infrastructure. The characteristic 'noise-free' is more precisely defined by the threshold of 55 dB, which marks the noise level for annoyance.[2] When drawing up boundaries for open spaces, it is especially important to ensure they are accessible so that people can experience them, as non-mechanised recreation is paramount here (Becker/Job/Koch 1991; Becker/Job/Witzel 1996). At the same time, traditional conservation and, in part, the protection of natural processes are promoted and general acceptance of open spaces is improved.

3 Established instruments for the preservation of open spaces

This chapter presents two instruments for the preservation of open spaces that have long been established in spatial planning in the Alpine states: the Bavarian Alpine Plan and the Tyrolean quiet areas. Due to the plethora of publications on this subject the discussion is kept relatively concise. Of course, there are more instruments for the conservation of open space than the traditional ones mentioned in the following discussion, e.g. conservation areas. However, discussion of these would exceed the scope of this article, especially as they are not (primarily) spatial planning instruments but rather sectoral planning instruments for nature conservation.

The Alpine Plan is a central element of the Bavarian State Development Programme (*Landesentwicklungsprogramm, LEP*) and since 1972 has regulated the development of (transport) infrastructure in the Bavarian Alps including roads, cable cars, ski lifts, ski slopes, airports, etc., as these projects are evaluated in advance from the perspective of federal state spatial planning. The aim is to prevent the overuse of nature and landscape and to reduce the risk of natural hazards (Hensel 1987: 270; Goppel 2003: 123). The various demands on land utilisation in the Alps (e.g. places where the local population can live and work and ecosystem services) should be balanced with recreation services and the requirements of the tourist industry and at the same time large areas of ecologically valuable Alpine open space should be protected (cf. *StMWIVT* [Bavarian Ministry of Economic Affairs, Infrastructure, Transport and Technology] 2006). The Alpine Plan creates a comprehensive solution that does not depend on decisions related to individual cases; rather the land-use demands are weighed up for the entire Bavarian Alpine region. These intentions behind the Alpine Plan were to be implemented with the help of a central instrument, the zoning of the whole of the Bavarian Alps (4,393.3 km², without the lakes) according to existing land use, ecological sensitivity and future development perspectives. The Bavarian Alps were divided by institutional regulation into three zones using these criteria. Each zone represents a territory for different primary functions and options for the future development of transport facilities, tourist accommodation and settlement expansion (cf. Barnick 1980: 4; Barker 1982: 282; Gräf 1982: 268; Grötzbach 1985: 152; Hensel 1987: 270; Goppel 2003: 123; Wessely/Güthler 2004: 52 et seq.; *StMWIVT* 2006; Speer 2008: 283 et seq., 286):

2 Cf. http://www.bafu.admin.ch/laerm/10312/10995/?lang=de (12 March 2018).

> Zone A, the infrastructure development zone (*Erschließungszone*) (1,548.3 km²; 35.24% of the Bavarian Alps as delimited in the Alpine Plan), includes all settlements and most areas with existing intensive land uses, e.g. valley areas and tourism locations, and is generally viewed as suitable for further infrastructure development (e.g. with ski lifts), with the exception of airports. It includes the settlement area and provides areas for ski tourism and other mechanised recreational activities and mass tourism offerings.

> Zone B (976.6 km²; 22.23%) serves as a buffer zone in which projects are only permitted after a detailed review and if they do not conflict with stricter regional planning requirements. Infrastructure projects require an individual assessment of their potential environmental impacts and are usually permitted if they are viewed as necessary for agriculture and forestry.

> Zone C, known as the Alpine quiet area (1,868.4 km²; 42.53%), is conceived as a protected zone in which all transport projects, with the exception of measures necessary for traditional agriculture and forestry, are explicitly prohibited and thus implicitly only non-intensive recreational activities adapted to the landscape and close to nature, such as hiking, cycling and cross-country skiing, are permitted. Zone C is generally not suitable for any sort of infrastructural development. The only exceptions are measures for tending to traditional cultural landscapes such as service roads for forestry and seasonal pasturing. Zone C mainly covers high mountain areas, conservation areas, almost all of the southern ridges bordering Austria, and the areas at high risk of erosion and avalanches.

In recent years comprehensive scientific evaluations (Job/Fröhlich/Geiger et al. 2013; Job/Mayer/Kraus 2014; Mayer/Strubelt/Kraus et al. 2016) have confirmed the effectiveness of the Alpine Plan for protecting the Bavarian Alps from overdevelopment without negatively influencing tourism trends. Indeed, strengthening the system of protected areas has ensured that there will be opportunities for recreational activities in semi-natural environments in the long term. However, the increasingly individualised nature of recreational sport in the Bavarian Alps (e.g. cross-country skiing, snowshoeing, riding electric mountain bikes) cannot be controlled by spatial planning instruments like the Alpine Plan. In conclusion, it can be noted that there has been no exception permit granted for an infrastructure project in Zone C since 1972, thus avoiding lengthy and conflictive debates about individual cases and high costs for administrative planning approval work, and thus preventing numerous infrastructure projects (cf. Job/Mayer/Haßlacher et al. 2017: 18 et seq.).

The Tyrolean quiet areas are an important Austrian instrument for conserving Alpine open space. They were first developed in 1972/1973 in the Landscape Plan drawn up by the Tyrolean state forestry inspection body (*Tiroler Landesforstinspektion*) for the whole of the Tyrol. In contrast to the Bavarian Alpine Plan (1972) and the Swiss 'Conservation inventory of landscapes and natural monuments of national impor-

tance'[3] (from 1977), produced at much the same time, this plan had no legal effect (Haßlacher 2016a: 7). The proposals for quiet areas made in the Tyrolean Landscape Plan were, however, taken up by regional planning. The legal anchoring of the quiet areas was implemented using ordinances in line with a resolution of the federal state government, but only after the Tyrolean Nature Conservation Law (*Tiroler Naturschutzgesetz, TNSchG*) of 1975. The safeguarding of Alpine open spaces through spatial planning is based on the technical foundations provided in the Tyrolean Recreational Space Strategy (*Tiroler Erholungsraumkonzept*), specifically in the chapters on tourism and Alpine spatial planning (Office of the Tyrolean Government [*Amt der Tiroler Landesregierung*] 1981).

According to the Tyrolean Nature Conservation Act, quiet areas are situated outside built-up areas and are particularly suitable for peaceful recreation and relaxation. They are free from noise-generating enterprises, public passenger transport and public roads. They are characterised in particular by clear bans with no exceptions: no establishment of noise-generating enterprises, no installation of cable car tracks for public transport and no ski lifts, no new roads for public transport, no significant noise generation (since 2015 this excludes measures for the energy transition) and no off-field landing or take-off of motorised aeroplanes for tourist purposes (with very isolated exceptions).

By locating the quiet areas so that they directly bordered skiing areas and roads, they were also used to fix the limits of development for engineered infrastructure. Owing to the clear bans they embody, quiet areas were preferred when designating conservation areas with the aim of setting definite limits to skiing areas (e.g. in Seefeld and in Achenkirch in the Karwendel mountains with the 'Eppzirl' and 'Achental-West' quiet areas). Landscape conservation areas cannot achieve this due to their weaker protective status. Quiet areas thus represent a consistent Alpine zoning designation to safeguard undeveloped open spaces, anchored in the sectoral planning of nature conservation. Specific nature conservation management tasks can then be agreed with landowners and local authorities at a later point (Haßlacher 2007b: 88).

Based on the various plans stemming from official regional planning, the Austrian Alpine Association (*Österreichischer Alpenverein*), the environmental protection department of the Office of the Tyrolean Government and the conservation area management bodies, eight quiet areas were approved and designated in Tyrol by the federal state government between 1981 and 2000 (Haßlacher 2016a: 7). With a total area of 1,370.94 km², they occupy 10.84% of Tyrol's land area, mostly in Alpine locations. For comparison, the permanently settled area in Tyrol is 11.8% of the total area. They have been able to prevent a series of infrastructural development projects (cf. Job/Mayer/Haßlacher et al. 2017: 28 et seq.).

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3 This national inventory comprises the most valuable landscapes and natural monuments in Switzerland, which are thus legally protected. This creates more legal and planning security in dealing with items listed in the inventory, and valuable landscapes worthy of protection are taken into consideration in spatial planning decision-making processes by the federation and cantons; cf. https://www.bafu.admin.ch/bafu/de/home/themen/landschaft/fachinformationen/landschaftsqualitaet-erhalten-und-entwickeln/landschaften-von-nationaler-bedeutung/bundesinventar-der-landschaften-und-naturdenkmaeler-von-national.html (11 May 2021).

Zone C of the Alpine Plan (since 1972) and the Tyrolean quiet areas (since 1975/1981) also fulfil – looking into the future – the framework convention of the Alpine Convention [4] (Article 2(2)i) and the associated protocol of the Alpine Convention on 'Spatial Planning and Sustainable Development' (Article 9(4)b)[5], 'Nature and Landscape Conservation' (Article 11(3))[6], 'Tourism' (Article 10)[7] and 'Energy' (Article 2(4))[8] in terms of the binding stipulation of Alpine quiet areas in the application of the Alpine Convention.

4 Cross-border cooperation with Austria for the preservation of open spaces in Bavaria

Although a positive judgement could be made concerning the fulfilment of the framework convention of the Alpine Convention and the associated protocol with zone C of the Alpine Plan and the Tyrolean quiet areas, this is less the case concerning the cross-border coordination of zone C of the Alpine Plan with the Tyrolean quiet areas and the nature and landscape conservation areas of Bavaria, Salzburg, Vorarlberg and the Tyrol. Figure 1 visualises the Alps in the border region of Germany (the south of Bavaria including the boundary with the Bavarian Alps according to the 1994 Federal State Development Programme (*StMLU* [Bavarian Ministry of Federal State Development and Environmental Affairs] 1994) and the Alpine Convention) and Austria (the north of Vorarlberg, Tyrol and Salzburg). The thematic focus is on types of open space stipulations and conservation areas. In Bavaria the areas that are protected by the conservation zone C of the Alpine plan in line with the Federal State Development Programme are visible; in Tyrol the equivalent – the quiet areas – are visible. In both countries the nature and landscape conservation areas are also indicated. Furthermore, the Berchtesgaden National Park is marked.

4 https://www.alpconv.org/fileadmin/user_upload/Convention/EN/Framework_Convention_EN.pdf (11 May 2021).

5 https://www.alpconv.org/fileadmin/user_upload/Convention/EN/Protocol_Spatial_Planning_EN.pdf (11 May 2021).

6 https://www.alpconv.org/fileadmin/user_upload/Convention/EN/Protocol_Conservation_of_Nature_EN.pdf (11 May 2021).

7 https://www.alpconv.org/fileadmin/user_upload/Convention/EN/Protocol_Conservation_of_Nature_EN.pdf (11 May 2021).

8 https://www.alpconv.org/fileadmin/user_upload/Convention/EN/Protocol_Energy_EN.pdf (11 May 2021).

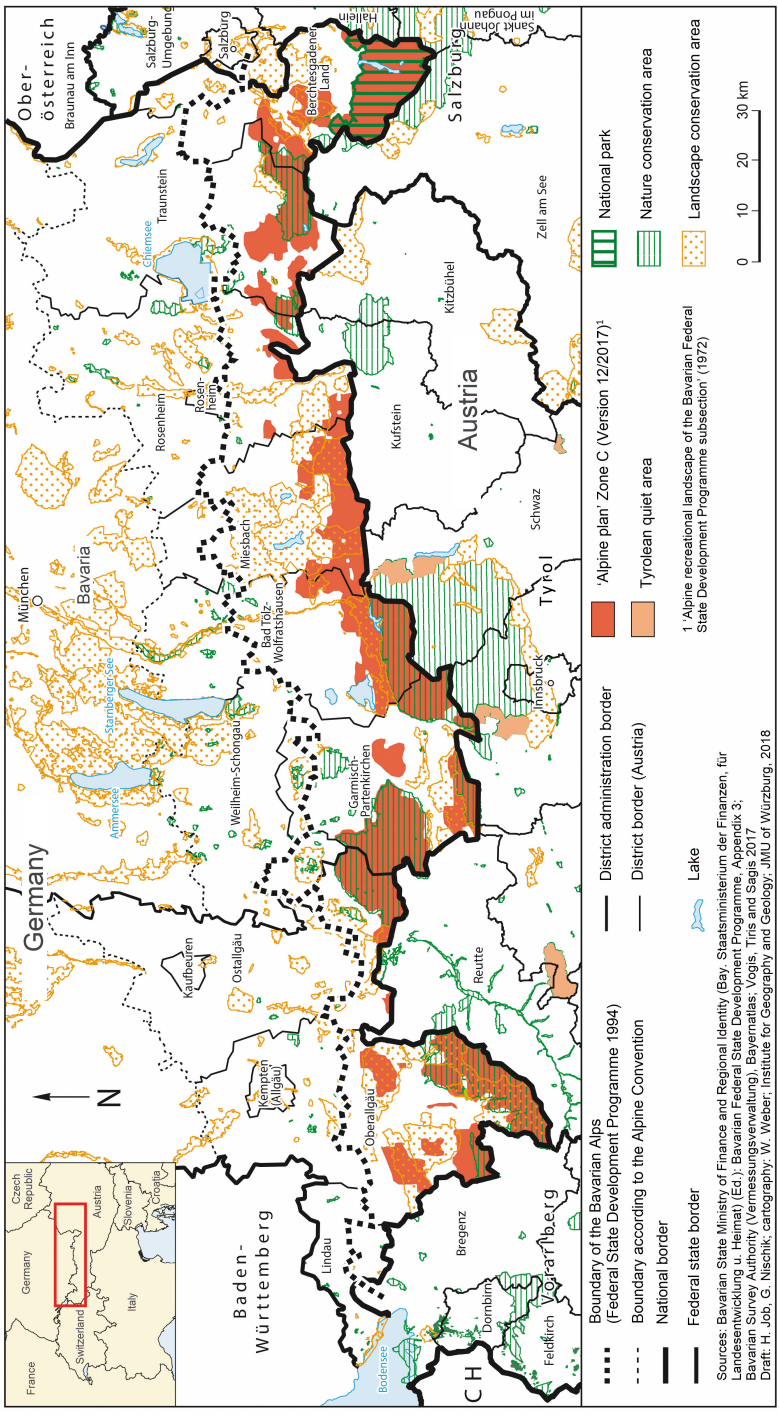

Fig. 1: Cross-border conservation areas of Bavaria and Austria

It can be seen that the designation of conservation zone C in the Alpine Plan and the Tyrolean quiet areas is not coordinated across the border. There are thus grave gaps in the preservation of Alpine open spaces. The other conservation areas also only meet at the national border in exceptional cases. Congruent conservation areas on the national borders of the two countries are only found in the Karwendel mountains (on the Austrian side the Eppzirl and Achental-West quiet areas, the Arnspitze, Reither Moor and Karwendel nature conservation areas, the Martinswand-Solstein-Reitherspitze, Nordkette, Vorberg, Falzthurntal-Gerntal, Bärenkopf and Großer Ahornboden landscape conservation areas, and on the German side the Karwendel and Karwendelvorgebirge nature conservation areas) and in the vicinity of the Berchtesgaden Alps/Salzburg Limestone Alps (for Austria the Gerhardstein-Hintertal-Weißbacher Almen, Göll-Hagen-Hochkönig-Steinernes Meer and Roßfeldstraße landscape conservation areas as well as the Kalkhochalpen nature conservation area, and in Germany the Berchtesgaden National Park).

On the Bavarian side many landscapes along the border with Austria are protected by conservation zone C in the Alpine Plan (e.g. Allgäu Alps, Ammer- and Wetterstein mountains and Chiemgau Alps). However, the protection is not continued on the Austrian side of the border, which contradicts the notion of the coordinated conservation of open spaces and the idea of ecological connectivity. (High-) mountain landscapes which are spatially defined by the natural landscape and not by administrative boundaries are only safeguarded in a dispersed manner with no transnational coordination of planning. It thus seems that much more intensive cross-border cooperation in spatial planning and spatially relevant sectoral planning is urgently required.

5 Analyses of non-legally binding approaches to the preservation of open spaces

In the wake of the discussion of established instruments for preserving open spaces, attention now turns to analyses of approaches to the protection of open space which are not implemented by spatial planning (cf. Job/Mayer/Haßlacher et al. 2017: 36 et seq.). These include the 'Alpine quiet areas' (*alpine Ruhezonen*) in the federal state of Salzburg, the 'white zones' (*Weißzonen*) in the federal state of Vorarlberg and the 'undeveloped areas' (*unerschlossene Gebiete*) of South Tyrol. In addition, the article presents an independent study of 'semi-natural open spaces' in the Swiss Alps.

In the following, four analyses of approaches to the identification and delimitation of open spaces in the German-speaking Alpine region are systematically compared using a number of indicators, and their commonalities and differences discussed. Firstly, an overview of the individual analyses of open space according to the selected indicators is presented as a table (cf. Table 1). It should be noted that there is a fundamental problem in comparing the analyses as the studies were conducted at different times, independently of one another, and had access to very different resources. Furthermore, the Salzburg study did not follow a traditional GIS-based approach.

	Alpine quiet areas – State of Salzburg	White zones – State of Vorarlberg	Undeveloped areas – South Tyrol	Semi-natural open spaces – Switzerland
Contracting authority/Initiative	Office of the Federal State Government of Salzburg *(Amt der Salzburger Landesregierung)*	Federal State Government of Vorarlberg *(Vorarlberger Landesregierung)*	Umbrella Association for Nature and Environmental Protection in South Tyrol *(Dachverband für Natur- und Umweltschutz in Südtirol)* (funded by the autonomous province of Bolzano/South Tyrol, Department for Nature and Landscape)	Swiss Federal Institute for Forest, Snow and Landscape Research *(Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft, WSL)* (Regional Economy and Development Research Group)
Edited by	Richard Schoßleitner – Office for Geography and Spatial Research	Manfred Kopf, Andreas Marlin, Stefan Obkircher – Department of Spatial Planning and Building Law (and Department of Climate Protection)	Kurt Kußtatscher, Ines Breitenberger – Office Trifolium	Marco Pütz, Christoph Knauf, Gero Nischik – Regional Economy and Development Research Group
Project start	unknown	2012	2009	2016
Research area (size)	• Austrian State of Salzburg • Size: 7,156 km²	• Austrian State of Vorarlberg • Size: 2,601 km²	• Autonomous province of Bolzano/South Tyrol • Size: 7,400 km²	• Swiss Alps (area in line with the Alpine Convention) • Size: 25,197.6 km²
Objectives	• Support the designation of Alpine quiet areas on local and regional level • Consultation for Federal State Development Programme update 2017	First phase: recording of untouched, semi-natural and little developed Alpine landscape areas Second phase: long-term safeguarding of these areas as white zones	Recording of undeveloped areas (residual landscape areas without fragmentation)	• Methodological operationalisation of the term/concept of open space • Identification and inventories of semi-natural open spaces in the Swiss Alps • Development of spatial types
Methodological approach for the stipulation of spatial units	Use of existing area designations	Hydrological modelling: 20,000 small catchment areas manually joined to form larger hydrological units (landscape units) (Grabher Environmental Office)	unknown	Hydrological modelling: 14,500 sub-catchment areas formed
Spatial unit used to assess the degree of infrastructural development	unknown	• Landscape units • Average size: 3.3 km² • Min. 0.27 km²; Max. 25.5 km²	• No spatial unit in the narrow sense • =Total state territory	Hydrological sub-catchment areas
Database of infrastructures	SAGISonline	VoGIS of the state of Vorarlberg	• Geo-browser of the autonomous province of Bolzano/South Tyrol • Paths-shapefile of the Office for Supra-Local Spatial Planning of the autonomous province of Bolzano/South Tyrol	• Infrastructures: TLM Switzerland • Elevation model: swissALTI3D • Basic geometry of Switzerland

Disruptive infrastructures	• Streets: National and federal state streets, streets of supra-local importance, municipal streets, private streets and tollways for public transport, large car parks >1,000 m² • Railways • Ski pistes including mechanical lifts, lift stations, reservoirs, snow machines, gastronomy and accommodation • Summer and winter toboggan tracks, leisure and amusement parks, motorsport facilities, shooting ranges, football and tennis facilities, mountain-bike downhill routes • Large camping sites, hotels, resorts, holiday villages • Airfields • Hydropower plants >15 MV bottleneck output solar plants over 200 m² collector surface, wind farms over 500 kW biomass heating systems of at least 100 MW, power lines large transformer stations • Landfills, central sewage treatment plant, storage areas >1,000 m² • Hazardous areas according to shooting and explosion regulations, abandoned landfill/contaminated sites, mining areas • Military restricted areas and facilities	• State roads, local roads, motorways, forest and supply roads, private roads • Mechanical lifts ski runs • Goods cable lift • Reservoirs • Overhead electrical power lines • Address points and/or buildings of over 200 m² • Railway tracks • Building sites in the preparatory land-use plan (building sites for core areas, residential areas, mixed use areas, commercial areas).	• Settled areas • Motorway, national roads, state roads, municipal roads, cycling paths, forest and Alpine paths, supply paths, private streets, other road infrastructure and roads 'under construction' • Railways • Tourist infrastructure like ski pistes, mechanical lifts and footpaths only used for visualisation	• All buildings • Public car park, private driving area, private car park, quiet area, public thoroughfares, motorway, entrance, exit, services, service entrance, road, 10 m street, 8 m street, 6 m street, 4 m street, 3 m street, square, access, road links • Standard gauge, narrow gauge with standard gauge, light railway, narrow gauge, car train • Gondola cableway, aerial cableway, chairlift, ski lift • Airfield, airport, aerodrome, heliport, grass runway, hard-surfaced runway, perron, grass taxiway, hard-surfaced taxiway • Leisure centre, golf course, racecourse • Swimming pool, sports ground, bobsleigh run, running track, toboggan run, butts, ski jump, sports ground • Antenna, aerial • Trade show grounds, hospital • Allotments • School, college • High-voltage line single pressure pipeline, multiple pipeline • Reservoir, dam, weir • Conveyor, gravel extraction, clay mining, quarrying • Wastewater treatment landfill • Wind turbines, hydropower plant, wood-fired power plant, solar power plant, biomass power plant • Emplacement • Zoo

Buffer around infrastructures	No buffer	Standard buffer of 200 m	Roads: standard buffer of 5 m	Differentiated into four buffer classes: 25 m, 200 m, 500 m and 1,000 m
Methodological basis for establishing the buffers	unknown	Established on grounds of plausibility	Disruption dependent on various factors so differentiation is impossible and a standard buffer used	• Differentiation into disruptive/non-disruptive • Various model runs and verification • Basis: LABES population survey, noise propagation
Methodology for GIS operations	Excluded areas approach	• Calculation of the 200 m buffer to an entire polygon (= infrastructure buffer) • Combination of infrastructure buffers with the landscape units • Calculation of the proportion of each landscape unit occupied by the infrastructure buffer (= degree of infrastructural development)	• Calculation of the 5 m buffer • Residual areas (in the sense of non-fragmented) are combined as individual non-developed areas	• Allocation of the infrastructures to a buffer class • Calculation of four buffer classes with corresponding infrastructures (= differentiated impact area) • Individual buffer areas combined into an entire polygon • Obtain degree of infrastructural development by calculating the proportion of area
Identified open spaces (number, average size)	unknown	• 83 white zones • Average size 988 ha	• 487 areas • • Average size 1,282.3 ha	• 415 semi-natural open spaces (minimum size 2 ha) • Average size 61.4 ha
Relationship of open spaces – research area	unknown	• A total of 800 km² of white zones were identified • Approx. 33% of state territory	• A total of 6,245 km² of undeveloped areas were identified • 84% of state territory	• A total of approx. 2,550 km² of semi-natural open spaces were identified • Approx. 10% of Swiss Alpine region
Spatial category/categories	• Excluded areas • Areas with potential Alpine quiet areas (also a planning category)	• Three categories of white zone: divided into core, buffer and development zones • 20% degree of infrastructural development in the core zone • Minimum size of buffer zone: 2 ha (in principle envisioned as a planning category)	• Undeveloped areas = residual areas without fragmentation situated between infrastructures • Minimum size: 100 ha • Divided into six size classes: 100–500 ha, 500–2,000 ha, 2,000–10,000 ha, 10,000–50,000 ha, 50,000–100,000 ha, 100,000–120,000 ha	• Classification into three spatial types • Spatial categories: semi-natural open space (infrastructural development 0% of disruptive infrastructure), transformed open space (0.1–20%), built-up space (>20%)

Table 1: Synopsis and synthesis of the analyses of approaches to the preservation of open spaces

When there is a planning intention to preserve semi-natural open spaces in the long term and to implement this as a legal obligation using spatial planning and spatially relevant sectoral planning, the body commissioning, implementing or conducting the analysis is of great significance. Thus the analysis for Vorarlberg was commissioned by the Vorarlberg state government and was conducted by a state agency, the department for spatial planning and building law. Such an approach can – if the political will

to implement it is not lost – be hugely effective in later implementation, especially due to the political goodwill that can be expected. On the other hand, when the will of individual political stakeholders is the driving force of such initiatives, this can also have a negative influence on the course of the project.

The execution of open space analyses depends on the timing, personnel and financial situation. If sufficient financial means are available then an external planning agency with specialised knowledge can conduct parts of the analysis, thus relieving pressure on internal staff and shortening the length of the project. Furthermore the level of knowledge is increased enormously by involving a larger circle of experts. It should be noted that more funding is often required for geodata. If those conducting the analysis are employees of the state then they usually have better access to data but, as described above, they are also more subject to path dependency. The projects upon which this study is based differ significantly in terms of personnel, time and funding. In any case it is an advantage if those conducting the analysis are familiar with the area being studied.

It can clearly be seen that the analyses of the open spaces were carried out at different times (between 2009 and 2017). The Swiss analysis of semi-natural open spaces was conducted after the studies in Vorarlberg and South Tyrol and drew some inspiration from these earlier studies in terms of preliminary considerations, procedure and implementation. The timing of the study also affects the 'state of the art' of knowledge and technology, of current challenges and awareness of problems and of spatial planning approaches (especially political 'windows of opportunity').

The research area in Vorarlberg is the smallest with an area of 2,600 km². In comparison the research areas of the Salzburg and South Tyrol studies, both about 7,300 km², are almost a third larger and the Swiss study is ten times bigger. The size of the area analysed is less significant because with appropriate data availability and calculating capacity the methodology can be applied to an area of any size. Nonetheless a smaller research area makes findings easier to verify and minimises the chore of defining spatial or landscape units in the field.

All the analyses synthesised here share the general objective of identifying undeveloped or semi-natural open spaces and safeguarding them in the long term. The open spaces or white zones were methodologically operationalised using the degree of infrastructural development in the Swiss and Vorarlberg studies, taking into consideration the accessibility of the landscape areas and the possibility of experiencing them through sustainable uses. The Salzburg study focused on the spatial planning implementation of 'Alpine quiet areas'. In contrast, the analysis in South Tyrol concentrated on undeveloped areas that are completely free from disruptive infrastructure and are thus unfragmented and extremely valuable for flora and fauna.

Hydrological modelling was used to define the spatial units in Vorarlberg and Switzerland. The sub-catchment areas that were thus created acted as the spatial units for further steps of the analysis (e.g. calculation of the degree of infrastructural development). In addition, landscape units were developed in the Vorarlberg study by manually combining catchment areas. This allows perceptual spaces to be considered but is

a very labour intensive procedure. For instance, it involved amalgamating about 20,000 small catchment areas to form 681 larger hydrological units, i.e. the landscape units. In this regard, the Swiss Alpine area is too large for this step of the analysis and therefore required more work.

The study in South Tyrol approached the object of research using the ecological function of open spaces. Here no spatial units were defined, rather the entire administrative area of the autonomous province was used as the spatial unit. The Salzburg study was based solely on existing territorial categories and approached the issue of open spaces through compatible or incompatible land uses. The latter define the exclusion zones. The remaining space is then the potential Alpine quiet areas. In Vorarlberg and in Switzerland the areas that were to be evaluated were defined prior to the analysis. In South Tyrol, in contrast, the open spaces or undeveloped areas were delimited only by the analysis itself (study of infrastructural development); the entire province served as the research area.

With reference to harmonising the methodological approach to defining Alpine open spaces it can be noted that the landscape units used in Vorarlberg are very good spatial units as they are based on the natural landscape and can be perceived and understood. Due to a lack of capacity and its large research area, the independently conducted Swiss study was unable to define landscape units initially. Instead the sub-catchment areas were selected and later in the analysis were amalgamated into larger areas with a similar degree of infrastructural development. In the future the aim should be to pursue the methods used in Vorarlberg here.

The database on which the studies were based was compiled by state institutions. Consequently the body of data is very dependent on national or state-affiliated efforts at compilation. The quality of the data can, however, be decisive for the results of the analysis, e.g. for the choice of infrastructures and buffers. All the studies except the Salzburg analysis also implemented cartographic elevation models to enable conclusions to be drawn about the altitude and slope gradient of the open spaces. The various infrastructures taken into consideration are primarily transport and settlement areas, although all the analyses also considered tourism and energy infrastructures. The Swiss analysis was able to differentiate very precisely between the different (technical) infrastructures, to define several buffer subcategories and also to distinguish between disruptive and non-disruptive infrastructure in terms of spatially relevant impact. All the analyses used buffers around infrastructures as a basic approach, except for the Salzburg study which omitted this owing to the legally anchored spatial planning focus on GIS analysis. The blanket buffering approach of the Vorarlberg study was based on the assumption that a 200 m buffer around each item of infrastructure methodologically combines the principle of preservation with recreation, experience and accessibility. The South Tyrol study used just a five-metre buffer around transport infrastructure with the justification that the disruptive impact of infrastructure depends on the surrounding landscape, the type of species affected and the amount of traffic, and that it is therefore not possible to capture their different disruptive impacts through the use of different buffers. In contrast, the Swiss analyses attempted to differentiate the disruptive impact of infrastructural developments using four buffer classes (25 m, 200 m, 500 m and 1,000 m) based on a survey of the

inhabitants and noise propagation. This certainly seems most appropriate for future procedures given the importance of its impact on people.

The studies in Vorarlberg and Switzerland are based on the methodological approach of an overlay analysis of infrastructural areas already provided with buffers and spatial units (landscape units vs. sub-catchment areas). In Vorarlberg the buffer was calculated for each of the ten aforementioned infrastructure datasets, summarised as one polygon, the infrastructure was amalgamated with the landscape unit and thus the degree of infrastructural development (proportion of area of the infrastructure buffer in the spatial unit) was calculated. In the South Tyrol study the undeveloped area was identified by extracting the polygon area of the infrastructure, including a five-metre buffer, from the total area of South Tyrol. These are two fundamentally different approaches (degree of infrastructural development vs. extracted area). The Salzburg study took yet another approach: here, types of use were matched with existing territorial categories.

In the Vorarlberg study, 83 white zones with an area of 800 km² were identified, equivalent to 33% of the area of Vorarlberg (around 2,600 km²). In South Tyrol, 487 undeveloped areas covering 6,245 km² were identified, equivalent to 84% of South Tyrol's land area (ca. 7,400 km²). The latter result is linked to the choice of methodology, which in a sense results in a simplified 'woodcut' and makes the findings difficult to compare and somewhat controversial. This approach views the topic of open space from a primarily ecological perspective and thus does not directly consider anthropogenic, semi-natural use. Furthermore the very low value selected for the buffers influences the results.

According to the definition used in Switzerland, 415 semi-natural open spaces with an area of 2,550 km² (10% of the Swiss Alps) were identified. The Swiss and South Tyrol studies map contiguous areas, while in contrast the Vorarlberg analysis presents isolated open spaces. All the analyses of open space derive their spatial categories from the open spaces identified. The Swiss study distinguished between open and built-up areas and divided the former into semi-natural (0% infrastructural development) and transformed open spaces (0.1–20% infrastructural development). The latter account for 37.1% of the area of the Swiss Alps. The South Tyrol analysis divided the undeveloped areas into six size classes, while the Vorarlberg study subdivided the white zones into a core zone, a buffer zone and a development zone. The Salzburg study distinguished suitable areas and exclusion zones. These completely different spatial categories demonstrate the possible spectrum of differentiation of Alpine open spaces.

In summary it can be stated that the open space analyses presented here differ greatly. This is related to the methodologies chosen and to the differences between the projects in terms of the availability of resources. These resources are related to the number of personnel, support from external specialists, financial and technical resources, and the available data. The availability of data through public channels is patchy in places or is associated with costs. The harmonisation of data, especially cross-border data, is very difficult. As soon as possible a state or state-affiliated institution like the Alpine Convention should set the objective of compiling and making

available complete datasets for the entire Alpine region so that substantive analyses of open space can be carried out. This is important in order to be able to view and treat the Alpine region as a coherent space in its entirety.

6 Conclusions

In the whole of the Alpine region the Bavarian Alpine Plan and the Tyrolean quiet areas are to date the only (binding) stipulations made in the context of the spatial planning of the nation states; there has similarly been no cross-border solutions. It can clearly be seen that the national state borders continue to create friction as they mark the delimitation of the validity of spatially relevant norms, both in terms of data availability and approaches to analysing open space and in terms of political steering approaches. There is obviously a lack of sensitivity among (political) decision makers about the fact that semi-natural open spaces are not perpetuated by chance and do not maintain themselves (Baier/Erdmann/Holz et al. 2006: 8). The consideration of nature and open space conservation in national sectoral legislation is usually rather symbolic in character and is seen as one public interest among many. Thus, what Baier/Czybulka/Erdmann et al. (2006: 566) correctly stated more than ten years ago continues to apply today: 'The public awareness of open space as an ecologically and socially valuable asset is just as lacking as an associated political, legislative and executive strategy for its preservation and development.'

Despite the many national borders in the Alps and the cross-border conventions, it can be seen that for the German-speaking Alpine region there has to date been no cross-border analyses or instruments and no harmonisation of instruments for the safeguarding of open spaces through spatial planning. There are a number of reasons for this:

> the difficult situation and pressure on land use and the resulting friction in the 1960s and 1970s with very different initial situations in the individual nation states (Ruppert 2004);

> clear linguistic, cultural and mental divides in the Alps and distinct sectoral responsibilities in terms of policy (Bätzing 2014);

> the different regulation of spatial planning powers and of the legal framework for sectoral planning for nature conservation in the different nation states (the problem of federalism) (Bätzing 2015);

> the differing significance of the Alpine Convention between the territorial states and the fact that it is not binding in terms of implementation (Haßlacher 2016c);

> problems associated with government policy in terms of regulations, funding policy and EU Cohesion Fund subsidies, e.g. in South Tyrol where mountain railways are often replaced after just 20 years (because this is more economically viable than technically complex upgrades) and the at times unnecessary

construction of service roads for pastureland and forestry in Bavaria, where for instance in Oberallgäu there are subsidies of up to 90% (Mayer/Strubelt/Kraus et al. 2016).

On the contrary, national 'go-it-alones' represent the majority and cross-border cooperation and agreement is insufficient or even absent – as has been seen in the case of the border between the Bavarian Alps and Austria. Recently, for example, competition with Austria in the field of winter sports tourism (cf. Job 2005; Mayer/Job/Kraus 2013) led to the eroding of the Alpine Plan despite the fact that this spatial planning instrument has wholly proved its worth ('Causa Riedberger Horn'). This has involved a reversal of the fundamental spatial planning perspective whereby the strategic and proactive coordination of contradictory spatial functions leads to an avoidance of conflict, in this case since 1972, successfully impeding the spiral of tourism expansion driven by municipal competition without hindering tourism (contrary to municipal investment competition). Such statements thwart the conservation of open spaces and weaken the potential of federal state spatial planning in terms of hard, long-term instruments. For issues like tourism and conservation areas that are central to the Alpine region and its foothills, considerably greater farsightedness would seem called for, especially in a Europe of regions. Nation states 'going it alone' do not provide sustainable solutions but rather underline the necessity of a comprehensive Alpine strategy and cross-border cooperation. Despite the justified criticism, the Alpine Convention and the European macro-regional strategy for the Alpine region (EUSALP) can therefore be judged as steps in the right direction.

The conservation of open spaces in the Alps is relevant for the protection of natural heritage (biodiversity), the preservation of landscape aesthetics, the safeguarding of the ecosystem services that these areas provide, and the provision of classic landscape-related recreation. This must be guaranteed without unnecessarily restricting the economy and transport, because the Alps need to be preserved as a place where the local population lives and works. In this context it is imperative that cross-border open spaces are designated strategically and that the associated planning instruments are implemented in spatial planning. The spatial planning institutions should fulfil their present-day role of coordinating conflicting land-use functions in the Alpine region. Thus, a better understanding of spatial and functional organisation based on land uses of differing intensities is required. Stronger safeguarding of open spaces through spatial planning is required (consistent implementation) to provide conservation areas for people and nature. A new spatial planning architecture that clearly defines areas for protection and for utilisation is also required (Haßlacher 2016b; Mayer/Strubelt/Kraus et al. 2016). And last but not least, what is absolutely required in the specific context of this study and owing to the common challenges and contiguous mountainous area is an Alpine-wide, methodologically comparative and above all cross-border analysis and significantly more cross-border cooperation. This would then provide a basis for spatial planning to safeguard open spaces in the Alps (cf. Job/Mayer/Haßlacher et al. 2017).

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The authors

Peter Haßlacher (†), *Chair of the International Commission for the Protection of the Alps Austria, Innsbruck*
E-mail: peter.hasslacher@cipra.org

Dr. Marco Pütz*, Swiss Federal Institute for Forest, Snow and Landscape Research (Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft, WSL), Birmensdorf/Zurich*
E-mail: marco.puetz@wsl.ch

Gero Willi (né Nischik)*, Swiss Federal Institute for Forest, Snow and Landscape Research (Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft, WSL), Birmensdorf/Zurich*
E-mail: gero.willi@wsl.ch

Christoph Knauf*, Julius-Maximilians-Universität of Würzburg*
E-mail: christoph.knauf@nk-masters.de

Jun.-Prof. Dr. Marius Mayer*, University of Innsbruck*
E-Mail: marius.mayer@uibk.ac.at

Prof. Dr. Hubert Job*, Julius-Maximilians-Universität of Würzburg*
E-mail: hubert.job@uni-wuerzburg.de