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Understanding the Determinants of Pro-Environmental Behavior among South Africans: Evidence from a Structural Equation Model

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Abstract: This paper explores the relationship between pro-environmental behaviour (PEB) and environmental awareness, knowledge, attitudes, risk perceptions and activism in South Africa. To achieve this goal, the 2010–2012 data from the International Social Survey Program "Environmental III" was analysed by means of descriptive and inferential statistics, including the employment of the structural equation model. Significant differences were found between pro-environmental behaviour and other environmental variables such as environmental concern, awareness, willingness to sacrifice, and others in terms of the educational background, place of living, ethnic identity and provinces where respondents lived. Thus, to increase PEB amongst citizens would require the introduction and support of development programmes that enhance access to more education and environmental awareness across all population groups.

Keywords: pro-environmental behavior; factors; structural equation model; significant differences; insignificant differences

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1. Introduction

Accelerated environmental damage and pollution is being increasingly recognized across the globe as one of the major causes of environmental change and decline, thus affecting the optimum functioning of the biosphere which is supporting ecological processes at various scales, environmental quality and human health. Such environmental damage is caused by unrestrained human activities in the form of unsustainable natural resource consumption, increased generation of hazardous wastes, air and water pollution as well as loss of biodiversity [1–4]. Therefore, many studies have identified environmentally unfriendly human behavior as one of the root causes of these problems, thus calling for increased pro-environmental behavior (PEB) to reduce such destruction and achieve sustainable development [5–7]. According to Lange and Dewitte [8], PEB entails the "commission of acts that benefits the environment and the omission of acts that harm it". In other words, PEB include many choices that individuals or groups of individuals make, the goal being to conserve the environment and reduce the consumption and destruction of natural resources [9–12]. PEB at the individual level is discernible from environmentally friendly activities such as waste recovery and recycling within households, decreased use of cars, avoiding air travel and not using plastic bags, and conserving natural resources such as water and energy [13,14]. In light of these activities, the question which arises is what factors can encourage or discourage PEB amongst individual citizens in any given country?

Since the human–environment relationship is complicated, the increase or decrease in PEB is attributed to many factors. Research on PEB generally falls into two categories. On the one hand, studies have examined the role of socio-demographic factors and, on the other hand, the moderating effects of socio-psychological constructs have been investigated. Whereas socio-demographical factors include education, age, and gender, amongst others [15,16], socio-psychological constructs involve the importance of environmental values, perceptions, attitudes and belief systems, and how they moderate PEB [17–20]. Many of the studies that used demographic characteristics such as gender, age, social class, place of living and education as predictors of PEB have yielded different conclusions. For example, Klineberg et al. [21] examined the influence of age, education, gender, ethnicity, household income, political ideology, and religion on the four dimensions of environmentalism. They found that age and education yielded significant variations in terms of environmentalism, although women tended to exhibit more pro-environmental attitudes and behavior than men in other studies. Research has also shown that educated individuals are relatively more knowledgeable about social welfare and environmental matters, thus more pro-environmental in outlook than their uneducated or less educated counterparts [17,22,23].

Furthermore, PEB may be estimated from factors such as awareness, knowledge, attitudes, perceptions, degree of activism as well as willingness to sacrifice for the environment (i.e., socio-psychological constructs). Whereas some of the literature has suggested no significant correlations between environmental knowledge and PEB [24,25], gaining such knowledge has been found to be a critical factor in encouraging environmentally friendly behavior [16,26]. For example, a study conducted in Singapore revealed that individuals with an improved knowledge about climate change are likely to make better decisions, thus reflecting positive attitudes and dispositions to engage in the desired PEB [26]. Closely related to these findings is empirical evidence emanating from Ghanaian research, whereby it was established that environmental knowledge is statistically significant in moderating PEB [23]. Nonetheless, just providing people with information or knowledge is not sufficient to effect the desired behavioral change. Instead, where and how the right information is communicated matters. In an earlier study conducted in Australia to assess water and energy conservations amongst residents [27], it was found that the delivery of such information to effect the desired behavioral change must happen at the place of interaction between residents and the point of environmental decisions that have to be made. Furthermore, studies on attitudes, perceptions of environmental risks, and willingness to sacrifice for the environment are receiving global attention. For instance, in Australia, China, and Lithuania, it has been demonstrated that the environmental perceptions of people are significantly correlated with higher levels of PEB [28–30]. Therefore, efforts that can increase the perception of environmental risks in society are likely to engender the desired PEB.

Despite the importance and proliferation of PEB research in the aforementioned countries, including developed countries such as Canada, Japan, Turkey, and the USA, there is limited scientific literature amongst African countries on the various factors that moderate and influence PEB [23,31,32]. More environmental behavioral research in African countries is needed as they are different from developed countries that have better governance systems and accountability, effective environmental legislation and regulation and its implementation as well as greater citizen engagement in the decision-making processes [33]. In developing countries such as those in Africa, there are pressing development challenges including rapid urbanization rates, high unemployment levels, and poverty. Additionally, environmental regulation and its enforcement is often poor due to lack of skills, maladministration and poor institutional arrangements [33,34]. Maloney and Ward [35] maintain that without relevant research on pro-environmental behavior, it is not possible to know what citizens are thinking about environmental

issues, impacts of environmental pollution, as well as their willingness and commitment to sacrifice for long term environmental sustainability. In view of this literature gap, this study seeks to gain a better understanding on the relationship between PEB on the one hand and socio-demographical and socio-psychological factors on the other hand, in South Africa. To shed more light on this research aim, the following hypotheses were formulated:

- There are no statistically significant relationships among socio-psychological variables such as environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception, activism and behavior;
- Socio-demographic factors (i.e., gender, age, marital status, educational background, place of living, ethnic identity and province) do not predict environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception, activism and environmental behavior;
- Environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception and activism do not predict environmental behavior.

2. Materials and Methods

The International Social Survey Program (ISSP) "Environmental III" data collected from 2010 to 2012 was used for this study. The ISSP is an international research group from 53 nations (ISSP http://www.issp.orgi, accessed on 1 February 2016) that undertake sample surveys of different topics across member countries. South Africa has been a member of this research group since the year 2003. South Africa has a human population of nearly 60 million inhabitants that is distributed in 9 provinces, as shown in Figure 1 [36]. The country lies at latitude 22° S to 35° S and longitude 17° E to 33° E, in the southernmost part of the African continent, and has a land area of 1,220,813 km^2. South Africa shares international borders with Namibia on the Atlantic coast, Mozambique on the Indian Ocean, and Botswana, Zimbabwe, and Swaziland. The provinces are as follows: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West and Western Cape (Figure 1).

In the collection of this data, a stratified multi-stage random sampling technique was employed in every country. The surveys were collected by means of questionnaire-administered face-to-face interviews. The data is nationally representative and the sample was comprised of the population aged 18 years and above. The ISSP survey has been used by various scholars in conducting their research, for example, Reyes [37] in a "cross-section analysis of attitudes towards science and nature" and Reyes [38] on "environmental attitudes and behavior in the Philippines". Other studies that have used the data to examine and predict environmental attitudes and behavior include the following: Franzen and Meyer [39]; Chapman [40]; and Reyes [41].

Unlike other studies on PEB, our paper used the structural equation model (SEM) to identify the determinants of PEB as well as the associations between them. According to Ng [42], "SEM proves to be a powerful tool to examine causal relations among multiple variables of different levels". Additionally, such analyses can be utilized to test whether or not a multivariate set of non-experimental data fits well on an existing theoretical framework. Our model was comprised of Environmental awareness (2 items), Environmental knowledge (2 items), Willingness to sacrifice (3 items), Environmental attitudes (7 items), Environmental risk perception (7 items), Environmental activism (4 items) were independent variables meanwhile the dependent variable was Environmental behavior (6 items). The descriptive statistics used for our data set is shown in Table 1.

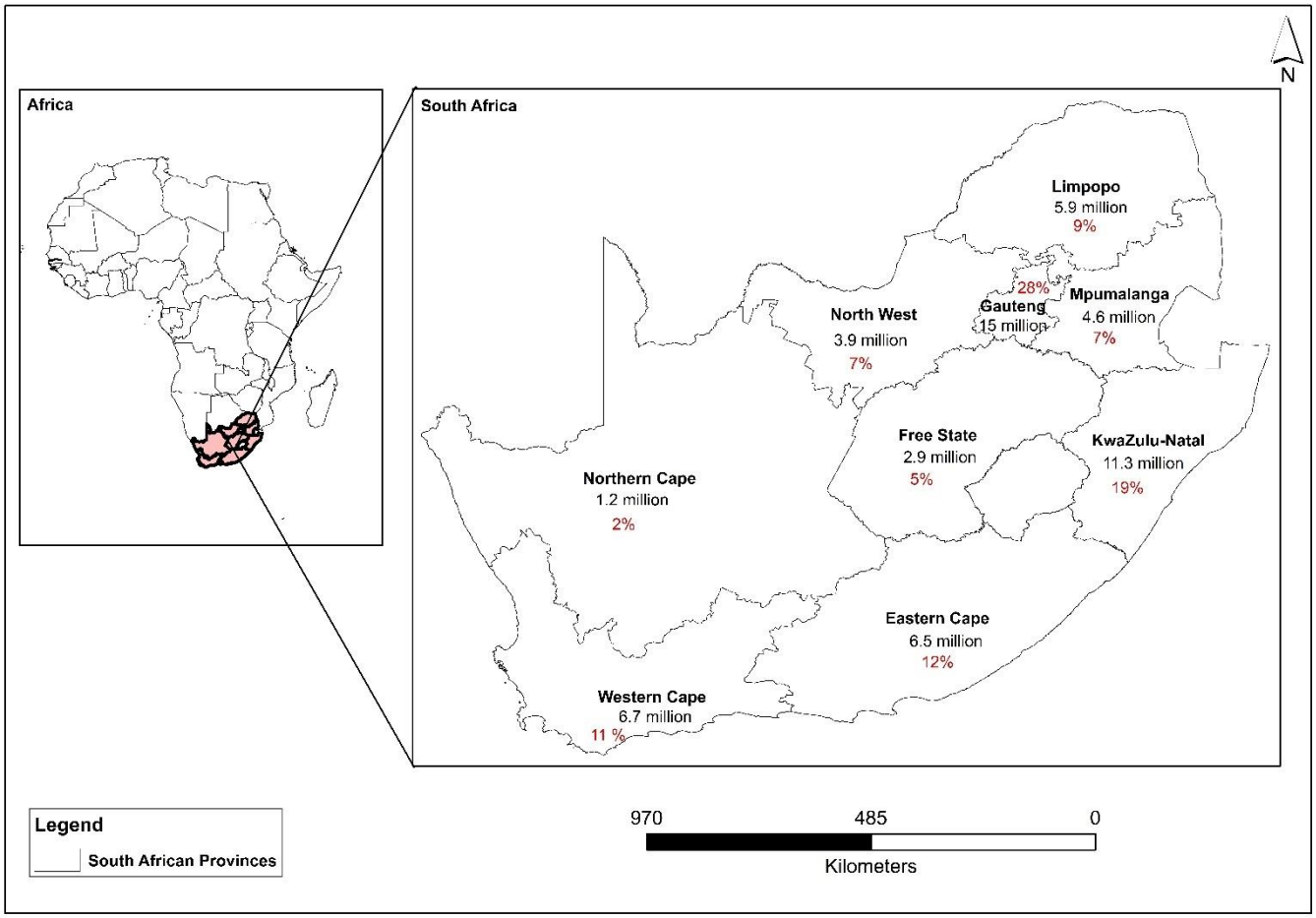

Figure 1. Different provinces of South Africa showing actual population numbers and proportions (%) of the national population.

Table 1. Descriptive data on the variables used in this study.

	N	Minimum	Maximum	Mean	Std. D
Environmental Awareness					
Most important issues for country today	3064	1	9	3.63	2.541
Next most important issue?	3040	1	9	3.89	2.704
Most important problem for country as a whole	2954	1	10	3.84	2.542
Most important problem which affects you and your family?	2965	1	10	4.52	2.754
Environmental Knowledge					
Causes of sorts of environmental problems	3044	1	5	2.80	1.179
Solutions to sorts of environmental problems	3027	1	5	2.65	1.184
Willingness to Sacrifice					
Protect environment: pay much higher prices	2971	1	5	3.52	1.335
Protect environment: pay much higher taxes	2910	1	5	3.65	1.293
Protect environment: cut your standard of living	2964	1	5	3.61	1.315
Environmental Attitude					
To do about environment: too difficult	3036	1	5	2.51	1.157
Do what is right costs money takes time	2999	1	5	2.96	1.107
More important things than protect environment	3001	1	5	3.08	1.129

Table 1. *Cont.*

	N	Minimum	Maximum	Mean	Std. D
No point unless others do the same	3000	1	5	2.71	1.153
Many about environment exaggerated	2810	1	5	3.00	1.123
Hard to know whether the way I live is helpful or harmful to the environment	2976	1	5	2.59	1.075
Environmental problems have a direct effect on my everyday life.	2928	1	5	2.52	1.048
Environmental Risk Perception					
Air pollution caused by cars is for environment	2989	1	5	2.11	1.076
Air pollution caused by industry is for environment	2996	1	5	1.79	0.925
Pesticides and chemicals used in farming are for environment	2895	1	5	2.34	1.160
Pollution river, lake-how dangerous for environment	2976	1	5	2.09	1.117
A rise in world's temperature caused by climate change	2907	1	5	2.12	1.089
Modifying the genes of certain crops is	2693	1	5	2.65	1.235
Nuclear power stations are	2757	1	5	1.95	1.052
Environmental Behaviour					
Effort: Sort glass for recycling	2533	1	4	3.29	0.951
Effort: to buy fruit and vegetables without pesticides or chemicals	2481	1	4	3.17	0.980
Cut back on driving a car for environmental reasons	1765	1	4	3.49	0.799
Reduce the energy or fuel at home for environmental reasons	3060	1	4	3.16	0.993
Save or re-use water for environmental reasons	3072	1	4	2.99	1.086
Avoid buying certain products for environmental reasons	3055	1	4	3.32	0.914
Environmental Activism					
Member of a group to preserve environment	3045	1	2	1.91	0.281
Last five years: signed a petition	3082	1	2	1.96	0.193
Last five years: given money to an environmental group	3082	1	2	1.95	0.211
Last five years: taken part in protest demonstration	3080	1	2	1.96	0.200

3. Results

3.1. Socio-Demographical Profile of Respondents

The socio-demographic characteristics of the respondents are indicated in Table 2. The sample was comprised of 40.7% male and 59.3% female respondents. In terms of race, 57.2% of respondents were composed of Black people, 18.1% Coloureds, 11.7% Indian/Asian people while 12.9% were White people. Concerning their educational levels, 26.4% had no formal education, 6.6% attained the lowest formal qualification, while 23.5% completed intermediate secondary education. By contrast, 29.3% of respondents completed higher secondary education and only 6.4% completed their university education. Whereas the province of KwaZulu-Natal had most (20.1%) respondents, the least represented provinces were the Northwest (5.3%) and Northern Cape (6.5%), respectively. Regarding the place of living, the majority of respondents lived (63%) in the big cities, 9.2% in the suburbs or outskirt of big cities, 19.1% in rural villages, while 8.7% lived in the farms (Table 2).

Table 2. Demographic characteristics of the respondents.

Sex	**F**	**%**
Male	1268	40.7
Female	1844	59.3
Total	3112	100.0
Ethnic group		
Black African	1781	57.2
Coloured	564	18.1
Indian/Asian	365	11.7
White	401	12.9
Total	3111	100.0

Table 2. *Cont.*

Sex	**F**	**%**
Place of living		
A big city	1961	63.0
The suburbs or outskirts of a big city	285	9.2
A country village	594	19.1
A farm or home in the country	272	8.7
Total	3112	100.0
Province		
Western Cape	392	12.6
Eastern Cape	412	13.2
Northern Cape	203	6.5
Free State	256	8.2
Kwa-Zulu Natal	624	20.1
North West	165	5.3
Gauteng	537	17.3
Mpumalanga	236	7.6
Limpopo	287	9.2
Total	3112	100.0
Educational background		
No formal qualification	823	26.4
Lowest formal qualification	205	6.6
Intermediate secondary completed	732	23.5
Higher secondary completed	912	29.3
University degree incomplete	175	5.6
University degree completed	199	6.4
No answer, other qualification, education	65	2.1
Total	3112	100.0

3.2. Assessing the Relationships between Behaviour and Other Environmental Variables

Based on our first hypothesis (H_1), there is no significant relationship between behavior and variables such as environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception, and activism. This hypothesis was tested by using bivariate correlations to determine the relationships between behavior and other environmental variables (Figure 2). Based on the results generated from this test, a highly positive significant association between environmental risk perception and environmental behavior (r = 0.086) was found. This means that respondents with higher levels of environmental behavior were more often individuals with relatively higher environmental risk perceptions. Similarly, those who were willing to make sacrifices for the environment (r = 0.430) and were environmentally active (r = 0.358) as well as being members of environmental groups (r = 0.271) were more likely to display pro-environmental behavior (PEB).

3.3. Analyzing the Determinants of Pro-Environmental Behaviour

According to our second hypothesis, socio-demographic factors (i.e., gender, age, marital status, education background, place of living, ethnic identity and province) will not predict environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception, activism or environmental behavior. To test this hypothesis, a multiple regression analysis was conducted and the findings are shown in Tables 3 and 4. The first analysis was to determine which of the socio-demographic variables exerted the greatest influence on each environmental variable. The results in Table 3 showed that gender, educational levels and the age of respondents exhibited significant contribution to the prediction of environmental awareness (EA) ($F(7, 2792) = 4.384$; $p < 0.001$). For the sub-category involving environmental knowledge (EK), socio-demographical variables explained 16.3% of the variance. The most parsimonious set of predictors

included membership of an environmental group, province, ethnic identity, place of living, highest education, age and gender. Regarding the willingness to sacrifice (WS) and place of living, there was a significant prediction (R^2 = 0.113; F(7, 2747) = 42.443; $p < 0.001$). Strongest predictors of PEB included age; highest educational attainments; place of living, population identity; province as well as membership of an environmental group. Together, these variables collectively explained 11.3% of the variance in the willingness to sacrifice for the environment. Regarding the environmental attitudes (EA) of respondents, the most parsimonious set of predictors included highest level education attained, ethnic identity, and province. It can be seen that socio-demographic variables exhibited significant contribution (R^2 = 0.034; F(7, 2951) = 11.109; $p < 0.001$) on most environmental constructs. For instance, together, these variables explained 34% of the variance in environmental attitudes amongst respondents.

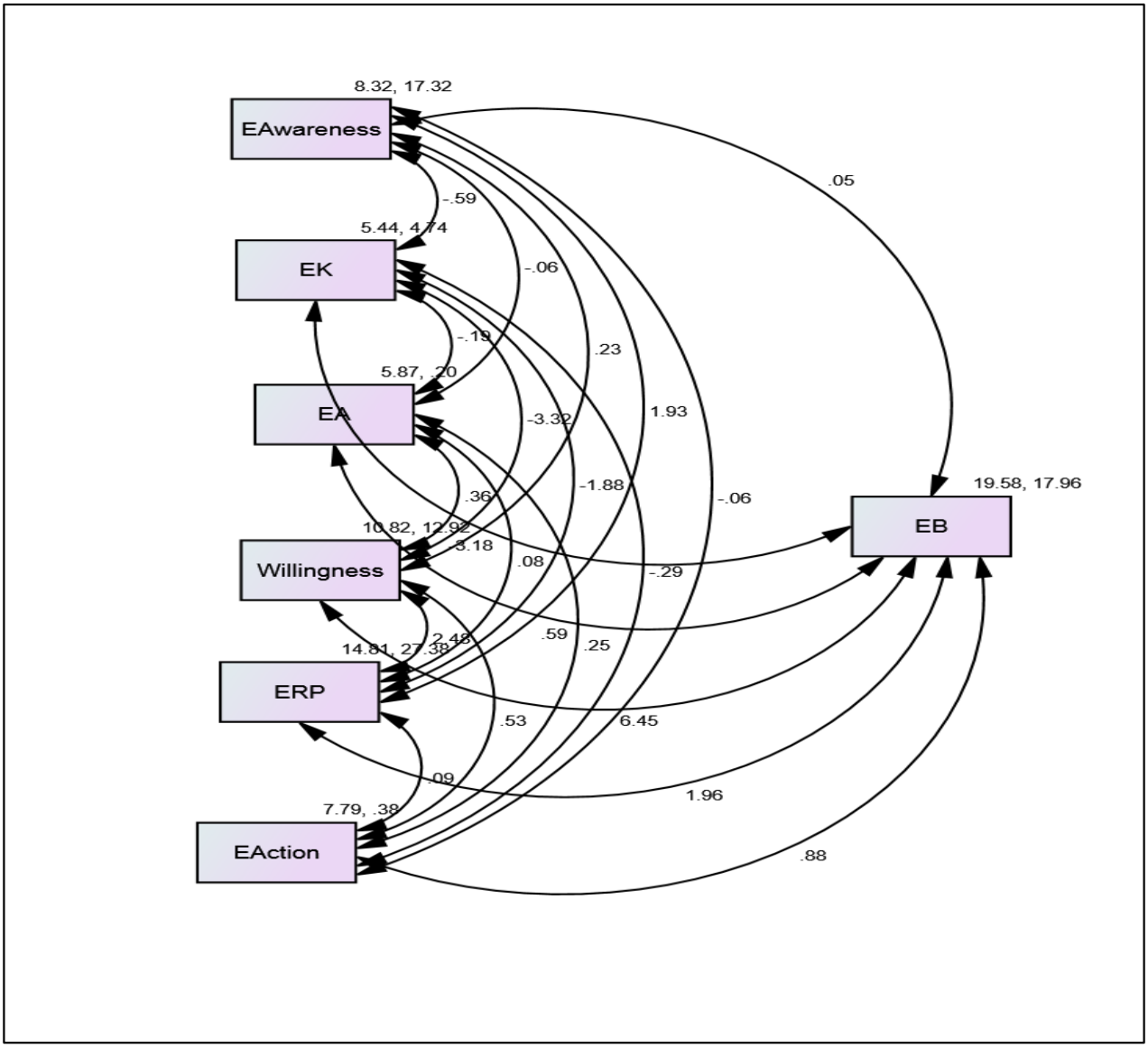

Figure 2. Bivariate correlations to show pro-environmental behavior. Note: Environmental Knowledge—EK; Willingness to sacrifice—WS; Environmental Attitudes—EA; Environmental Risk Perception—ERP; Environmental Behaviour—EB; Environmental Activism—EActivism.

Table 3. Multiple regression analysis of demographic variables to predict environmental variables.

	EA		EK		WS		EA		ERP		EB		EActivism	
	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
(Constant)		0.000		0.000		0.000		0.000		0.000		0.000		0.000
Sex	−0.018	0.352	−0.052	0.003	−0.004	0.820	0.007	0.730	−0.029	0.155	0.002	0.923	0.007	0.686
Age	−0.024	0.280	−0.055	0.005	0.081	0.000	0.004	0.852	−0.037	0.113	0.045	0.046	0.003	0.898
Marital status	0.017	0.417	0.003	0.869	0.007	0.729	0.007	0.737	0.007	0.763	0.005	0.806	−0.006	0.745
Highest educ.	−0.005	0.807	0.169	0.000	−0.129	0.000	0.107	0.000	−0.071	0.002	0.038	0.091	−0.076	0.000
Place of living	−0.055	0.012	−0.102	0.000	0.071	0.001	−0.005	0.818	0.093	0.000	−0.036	0.113	0.041	0.035
Ethnic identity	0.041	0.077	0.162	0.000	−0.082	0.000	0.092	0.000	−0.114	0.000	0.046	0.051	−0.055	0.008
Province	−0.065	0.001	0.142	0.000	−0.184	0.000	−0.070	0.001	−0.132	0.000	0.030	0.135	0.001	0.946
Membership of environment group	−0.019	0.335	−0.132	0.000	0.124	0.000	0.028	0.156	−0.025	0.222	0.061	0.002	0.372	0.000
	R = 0.112 R^2 = 0.013 F(7, 2792) = 4.384; *p* < 0.001		R = 0.404 R^2 = 0.163 F(7, 2892) = 70.125; *p* < 0.001		R = 0.336 R^2 = 0.113 F(7, 2747) = 42.443; *p* < 0.001		R = 0.183 R^2 = 0.034 F(7, 2951) = 11.109; *p* < 0.001		R = 0.235 R^2 = 0.055 F(7, 2369) = 19.297; *p* < 0.001		R = 0.335 R^2 = 0.112 F(7, 1515) = 10.881; *p* < 0.001		R = 0.400 R^2 = 0.160 F(7, 2911) = 13.725; *p* < 0.001	

Note: Environmental Knowledge—EK; Willingness to sacrifice—WS; Environmental Attitudes—EA; Environmental Risk Perception—ERP; Environmental Behaviour—EB; Environmental Activism—EActivism.

Our last hypothesis (no.3) stated that variables such as environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception and activism will not predict environmental behavior. In this instance, a stepwise multiple regression analysis comprised of five different models was conducted to determine whether the six environmental variables and sociodemographic variables would predict environmental behavior (Table 4). Based on the results displayed in Table 4, willingness to sacrifice for the environment was the strongest predictor of environmental behavior (R^2 = 0.218; $F_{(1, 806)}$ = 224.84; $p < 0.001$). This variable exhibited positive significant effects on PEB as shown in Model 1. When environmental action was included into the modelling (Model 2), we found a significant prediction of environmental behavior (R^2 = 0.303; $F_{(2, 805)}$ = 174.755; $p < 0.001$). This predicted 30.3% of the variance in environmental behavior. Additionally, environmental action was found to exert a significant contribution (ΔR^2 = 0.085; ΔF = 97.699; $p < 0.001$) in this model, thereby accounting for 85% of the variance of environmental behavior over the contribution of willingness to sacrifice for the environment. Model 3 shows that willingness to sacrifice for the environment, environmental action and environmental knowledge (R^2 = 0.332; $F_{(3, 804)}$ = 133.486; $p < 0.001$) are related to environmental behavior. The inclusion of environmental knowledge made significant contribution (ΔR^2 = 0.030; ΔF = 35.826; $p < 0.001$) to the prediction of the dependent variable.

In Model 4, the residential province as one of the socio-demographical variables of respondents was included. Together with willingness to sacrifice for the environment, environmental action and environmental knowledge, this variable significantly predicted environmental behavior (R^2 = 0.336; $F_{(4, 803)}$ = 101.739; $p < 0.001$). In the final model (Model 5), willingness to sacrifice, environmental action, environmental knowledge, province and place of living (R^2 = 0.340; $F_{(5, 802)}$ = 82.511; $p < 0.001$) were found to significantly predict environmental behavior.

Table 4. Stepwise multiple regression analyses of predictors of pro-environmental variable of South Africans.

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		Model Summary
		B	Std. Error	Beta			Tolerance	VIF	
1	(Constant)	12.725	0.411		30.991	0.000			
	Willingness to sacrifice	0.575	0.038	0.467	14.995	0.000	1.000	1.000	$R^2 = 0.218$; $F_{(1, 806)} = 224.84$
2	(Constant)	1.333	1.216		1.096	0.274			
	Willingness to sacrifice	0.468	0.038	0.380	12.372	0.000	0.918	1.089	
	Environmental Action	1.631	0.165	0.304	9.884	0.000	0.918	1.089	$R^2 = 0.303$; $F_{(2, 805)} = 174.75$; $\Delta R^2 = 0.085$; $\Delta F = 97.69$
3	(Constant)	5.538	1.383		4.006	0.000			
	Willingness	0.382	0.040	0.311	9.632	0.000	0.799	1.252	
	Environmental Action	1.497	0.163	0.279	9.183	0.000	0.901	1.110	
	Environmental Knowledge	−0.391	0.065	−0.190	−5.986	0.000	0.822	1.216	$R^2 = 0.332$; $F_{(3, 804)} = 133.48$; $\Delta R^2 = 0.030$; $\Delta F = 35.826$
4	(Constant)	6.345	1.429		4.440	0.000			
	Willingness	0.375	0.040	0.304	9.426	0.000	0.793	1.262	
	Environmental Action	1.474	0.163	0.275	9.045	0.000	0.897	1.115	
	Environmental Knowledge	−0.392	0.065	−0.191	−6.017	0.000	0.822	1.217	
	Province	−0.111	0.052	−0.063	−2.161	0.031	0.983	1.017	$R^2 = 0.336$; $F_{(4, 803)} = 101.73$; $\Delta R^2 = 0.004$; $\Delta F = 4.671$
5	(Constant)	6.113	1.431		4.272	0.000			
	Willingness to sacrifice	0.376	0.040	0.305	9.463	0.000	0.793	1.262	
	Environmental Action	1.452	0.163	0.270	8.905	0.000	0.893	1.120	
	Environmental Knowledge	−0.360	0.067	−0.175	−5.385	0.000	0.777	1.288	
	Province	−0.143	0.054	−0.081	−2.663	0.008	0.897	1.114	
	Place of living	0.214	0.106	0.062	2.013	0.044	0.856	1.169	$R^2 = 0.340$; $F_{(5, 802)} = 82.5$; $\Delta R^2 = 0.003$; $\Delta F = 4.05$

Dependent Variable: Environmental Behaviour. Step 1: Predictors: (Constant), willingness to sacrifice. Step 2: Predictors: (Constant), willingness to sacrifice, environmental action. Step 3: Predictors: (Constant), willingness to sacrifice, environmental action and environmental knowledge. Step 4: Predictors: (Constant), willingness to sacrifice, environmental action and environmental knowledge, Province. Step 5: Predictors: (Constant), willingness to sacrifice, environmental action and environmental knowledge, Province, Place of living.

4. Discussion of Results

This study is making an important contribution towards understanding PEB and its determinants amongst respondents from the South African population. However, before the results are discussed, it is important to explain the meaning of some of the demographics about respondents. Women were over-represented (59.3%) in this survey as they constituted about 51% of South Africa's total population in 2019 [36]. While the

proportion (57.2%) of Black people who featured in the survey was significantly low compared to their national total (80%), other population groups featured relatively higher than their national proportions. For instance, although the national proportion of Indians in South Africa is about 2.6%, in this survey it was as high as 11.7%, thus suggesting an over-representation [36]. Other discrepancies with national statistics were observed regarding the proportions of populations living in different provinces. For instance, the province of KwaZulu-Natal attracted about 20.1% of respondents to the present survey even though Gauteng is the biggest province (28%) in South Africa in terms of population size and economic importance.

The data analysis in the previous section tested three different hypotheses to help illuminate some light on the various determinants of PEB amongst the respondents. In terms of the first hypothesis, a highly positive significant relationship between environmental risk perception and environmental behavior (r = 0.086) was found. In the same way, willingness to make sacrifices for the environment (r = 0.430), environmental activism (r = 0.358) and membership of environmental groups (r = 0.271) exhibited positive influences on PEB. It is clear that these variables are affecting environmental behavioral outcomes in a positive manner, at least amongst the respondents who were interviewed for this study. Several studies have indicated that there is a positive relationship between an individual's willingness to sacrifice for the environment and PEB [43–45]. Therefore, individuals with higher willingness to sacrifice for the environment are more likely to exhibit environmentally responsible behavior [43,46,47]. In the same vein, a positive association between environmental activism and PEB among Australian university students has been reported by previous studies [48], although such a relationship was refuted in a different study conducted in the United States [49]. While environmental risk perceptions exhibited a positive influence on environmental behavior in the present study, it is imperative to recognize that perceptions are multidimensional and emanate from different sources. A recent study conducted in South Africa revealed the importance of socio-economical factors such as places of residence, migration status, employment status, as well as the importance of education in moderating environmental perceptions [50].

By making use of multiple regression analysis, the hypothesis (no.2) that socio-demographic factors will not predict environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception, activism and environmental behavior was tested. Our results based on ANOVA revealed significant differences between some of the socio-demographic variables and environmental behavior and other sub-categories. These relationships were adequately accounted for in the various scenarios modelled into our structural equation model. We found significant differences in environmental knowledge and willingness to sacrifice for the environment according to age. This means that younger and older individuals differ in terms of their willingness to sacrifice for the environment. This finding lends support to the South African White Paper on Education and Training, which makes provision for the teaching of environmental education throughout all learning areas, starting at Grade R until Grade 12 in the national school system. In that way, learners are enabled to become environmentally literate and aware, and to conduct their affairs in an environmentally responsible manner now and when they become adults [51,52].

Other findings were associated with the third hypothesis, which was based on the point that other environmental variables such as environmental awareness, knowledge, willingness to sacrifice, attitudes, risk perception and activism will not predict environmental behavior. The results indicated statistically significant differences between environmental behavior and other variables such as environmental concern, awareness, willingness to sacrifice, attitudes, risk perception and activism in terms of place of living and provinces. Similar results have been reported by Telešienė and Balžekienė [53], thus demonstrating that environmental behavior is affected by contextual factors such as place of living, ethnic identity and education. In fact, the latter point has been corroborated in several studies [54–56] where a positive relationship between education and PEB was found. Lastly, we found that willingness to sacrifice for the environment, environmental activism, and

environmental knowledge are all predictors of PEB, thus in agreement with the study of Ergena et al. [57] as they reported similar findings. These findings provide guidance on what interventions are necessary for raising the profile of environmental stewardship amongst citizens in South Africa. Increasing interventions that will raise environmental awareness and literacy within the South African population may bring about the desired environmentally responsible behavior such as increased energy and water conservation, green purchases, and more household waste reuse and recycling [58–60].

5. Conclusions and Implications

The aim of this paper was to describe and examine the extent to which various factors influence PEB amongst respondents sampled from the South African population. By analyzing the South African data obtained from the International Social Survey Program (ISSP), we have contributed further insights into the literature on the determinants of PEB. By testing various hypotheses, it was possible to assess the relationships between environmental behavior and various socio-psychological and socio-demographic factors. Firstly, a highly positive significant relationship was found between environmental risk perception and environmental behavior (r = 0.086). Similarly, willingness to make sacrifices for the environment (r = 0.430), environmentally activism (r = 0.358) and memberships of environmental groups (r = 0.271) also displayed positive influences on PEB. Therefore, raising the value of these constructs in society may encourage more PEB amongst the respondents who participated in this study as they reflect an important segment of the South African population. However, it is imperative to realize that some of these factors have different layers of influence and originate from different sources. For example, to change people's environmental behavior is not exclusively a function of their attitudes toward the natural world. Instead, it depends to a large extent on their individual understanding of existing social relations and "within what human identities they situate themselves" [61].

Secondly, with the aid of multiple regression analysis, the relationship between socio-demographic factors such as gender, age, marital status, educational background, place of living, ethnic identity and province and socio-psychological constructs such as environmental awareness and willingness to sacrifice, amongst others, were determined. The findings showed significant statistical differences between some of the socio-demographic variables and environmental constructs. For instance, it was found that there are significant differences in environmental knowledge and willingness to sacrifice for the environment according to age. Therefore, if younger people have limited environmental knowledge or are less inclined to sacrifice for the environment, it is imperative to equip them with environmental education throughout their school career, a policy intervention that is already being implemented in South Africa.

Thirdly, the research has established how certain environmental variables can predict PEB. Statistically significant differences were found between environmental behavior and other variables such as environmental concern, awareness, willingness to sacrifice, attitudes, risk perception and activism in terms of place of living and the different provinces of South Africa. The major implication of this finding is that PEB can be improved by raising the importance and profile of these socio-psychological factors in society. At the same time, the moderating role of 'place of living' and 'provinces' where people live is important. This suggests that different communities in South Africa have unique geographical attributes worthy of being taken into consideration when policy interventions are being designed.

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Institutional Review Board Statement: Our study made use of secondary data collected by the International Social Survey Programme. The ISSP General Assembly (GA is the main deliberative, decision making and representative organ of the ISSP and maintains high ethical standards in the collection of data from participants. The questions are approved by the GA based on their scientific merit, sociopolitical relevance and ethical appropriateness. ISSP members, the national field questionnaires and field work, all comply with the given legal requirements in each country. Before data is deposited into the ISSP Archive, national ISSP data are anonymized so that individual survey participants cannot be identified.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study and data anonymity was maintained.

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