

# Environmental Attitudes in Cross-National Perspective: A Multilevel Analysis of the ISSP 1993 and 2000

Axel Franzen and Reto Meyer

This article discusses the determinants and the development of public concern for the state of the natural environment. First, we review some theoretical approaches that try to explain individual as well as cross-national differences in environmental attitudes. Particularly, we discuss Inglehart's theory of post-materialism, Dunlap and Mertig's globalization explanation, and the prosperity hypothesis. Second, we test these hypotheses by applying multilevel analysis to the International Social Survey Programme (ISSP) data from the years 1993 and 2000. The results support, above all, the prosperity hypothesis. Individuals with higher relative income within countries display higher levels of environmental concern than their compatriots, and additionally, more concern is reported in wealthier countries than in poorer nations. The results indicate that environmental concern is also closely associated with post-materialistic attitudes and various socio-demographic variables. Comparing the environmental concern measured in the ISSP in 1993 with that in 2000 shows that environmental concern has more or less stabilized since the early 1990s in the countries under scrutiny.

## Introduction

The state of the planet has been increasingly becoming a public concern since Meadows and Meadows (1972) published their report 'The Limits of Growth' to the Club of Rome and since the International Panel of Climate Change (IPCC) and other institutions such as the World Watch Institute collect and publish evidence on the state of the natural environment on a regular basis. The UN has organized several international summits such as the Climate Conference in Rio in 1992, the Kyoto conference in 1997, and recently the follow-up conference in Bali in 2007. Meanwhile, many

national governments and particularly the EU agree at least in principle on the necessity of increasing global efforts to protect the environment, and particularly of reducing CO<sub>2</sub>-emissions in order to reduce global warming. These environmental agreements call for radical changes in energy production and consumption both in industrialized as well as in developing nations. Such reorganizations of economies require fundamental changes in the behaviour of producers and consumers. It is therefore crucial to the implementation of environmental agreements that citizens and voters share these environmental concerns and are willing to incur the costs that are associated with the

changes in energy production and consumption. Social research has therefore focused on monitoring the development of public environmental awareness as well as on explaining individual as well as cross-national differences of public environmental concern.

However, explaining the individual and cross-national differences is still a controversial issue in environmental research. On one hand, some authors, most prominently Ronald Inglehart (1995), have argued that citizens of wealthier nations display more pro-environmental attitudes because of a general shift from materialistic to post-materialistic values in modern societies. Dunlap and Mertig (1997), on the other hand, have opposed this view and argue that environmental concern is even higher in poorer nations, a finding which has lately been reconfirmed by Gelissen (2007). Still others (e.g. Diekmann and Franzen, 1999; Franzen, 2003) found that wealth and environmental concern are positively associated but that the wealth effect is not necessarily dependent on a fundamental value transformation as argued by Inglehart.

This paper has a 2-fold purpose. We first compare the level of environmental attitudes as well as its development in the nations that participated in the International Social Survey Programme (ISSP) in 1993 and 2000. Second, we analyse the ISSP by applying multilevel models to the data in order to explain the individual as well as the country-level differences. Next to the World Value Survey (WVS) and the Health-of-the-Planet (HOP) study, the ISSP is one of three available data sources that permits cross-national comparison. All of these data sources have already been analysed. However, most existing studies are either restricted to the macro level (e.g. Inglehardt, 1995; Dunlap and Mertig, 1997; Franzen, 2003) or to the individual level (e.g. Kimmelmeyer, Król, and Kim, 2002) but did not take the multilevel nature of the data into account. Restriction to the macro level bears the danger of committing an ecological fallacy: thus, the wealth of nations (a macro variable) might be related to a country's mean level of environmental concern. However, the correlation could be due to some other influence besides wealth. Restriction to the individual level, on the other hand, leaves out other potentially important determinants such as a nation's environmental quality, its distribution of wealth or its population density. Our analyses show that cross-national as well as between individual differences in environmental concern are clearly related to wealth and income respectively, which lends strong support to the prosperity hypothesis.

The paper will proceed as follows: In the following section, we discuss the competing theoretical approaches to explain national as well as individual differences of attitudes towards the environment in more detail. We also take additional factors, such as population density and measures of environmental quality, into consideration. On the individual level we discuss the possible effects of age, education, income and post-material values on pro-environmental attitudes. The third section presents an empirical analysis of the development of environmental concern as measured by two waves of the ISSP in 1993 and 2000. The section presents both descriptive results and a multilevel analysis of the differences found among individuals and societies. Finally, in the fourth section, we summarize and discuss our main findings and conclusions and highlight the differences to other findings.

## The Origin of Environmental Concern

Environmental concern is defined as the awareness or insight of individuals that the natural state of the environment is threatened through resource overuse and pollution by humans (e.g. Dunlap and Jones, 2002). Individuals differ with respect to their concern for the environment and there are at least three hypotheses trying to explain this variation: Inglehart's (1995, 1997) post-materialism hypothesis, Dunlap *et al.*'s hypothesis (1993, 1995, 1997) that environmental concern has spread globally and, finally, the prosperity or affluence hypothesis, which has its origin in classical economic reasoning (e.g. Baumol and Oates, 1979; Field, 1994) and has lately been confirmed by Diekmann and Franzen (1999). According to Inglehart (1995, 1997), environmental awareness is part of a general change in fundamental values that take place as societies develop. As societies become more affluent, their members are less pre-occupied with the economic struggle for survival and are free to pursue what Inglehart termed post-materialistic goals, such as political freedom, individual self-fulfillment, and environmental protection. Inglehart asserted that the shift from materialism to post-materialism is irreversible as long as material prosperity continues. He used data from the World Values Survey to test the hypothesized positive correlation between prosperity and environmental concern. However, the data only partially supported his hypothesis, since some of the countries whose citizens displayed high levels of environmental concern

were developing nations. In response to this unexpected finding, Inglehart formulated his 'objective problems and subjective values' hypothesis. According to this, members of wealthy societies take on pro-environmental attitudes in the process of adopting post-materialistic values in general. In other words, their environmental attitudes are not necessarily formed in response to immediate problems. Citizens of poorer nations, on the other hand, are faced with pressing local environmental problems (e.g. polluted cities, lack of access to clean water, and soil degradation) and interested in the resolution of these objective problems. Thus, environmental awareness can be a consequence of prosperity, albeit not a direct one as it is mediated by a change from materialist to post-materialist values. However, those in poorer nations also display high concern for the quality of the environment. Their concern stems from concrete and immediate local problems rather than from a shift to post-materialist values. Thus, Inglehart postulates two independent effects on environmental concern, first a positive of post-material values and second a negative effect of environmental quality, e.g. the better the environmental quality the less concern.

Inglehart's position has been challenged by Dunlap and Mertig (1994, 1995, also see Dunlap, Gallup and Gallup, 1993), who argue that environmental awareness is not influenced by a country's wealth, but has instead become a global phenomenon. Specifically, they argue that environmental concern exists in many third-world countries as well as industrialized countries, an assertion that is in line with earlier work on the development of a 'new ecological paradigm' (Dunlap and van Liere, 1978). Just as they argue that environmental concern is not limited to citizens of wealthy nations, they also claim that it is not confined to the elites within those wealthy nations, but has instead spread to the general population. They support their assertion with empirical evidence from the Health of the Planet Survey (HOP, Dunlap, Gallup and Gallup, 1993). Dunlap and Mertig (1994, 1995) even present results from further analysis of the HOP data showing that the percentage agreement with most of the survey's environmental-concern items are negatively correlated with *per capita* GNP.

There is a third approach, which we call the prosperity or affluence hypothesis (Diekmann and Franzen, 1999). Following the arguments typically advanced in environmental economics (e.g. Baumol and Oates, 1979; Field, 1994), we assume that the quality of the environment is not only a public good but also a good the demand for which rises with income. Furthermore, we assume that individuals face

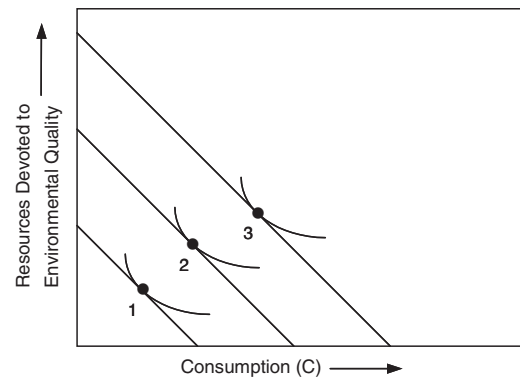
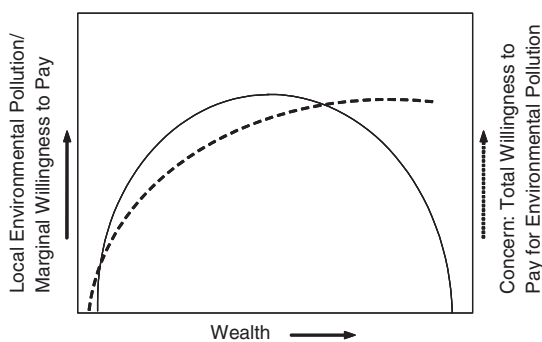


Figure 1 Wealth and environmental concern

a trade-off between consumption of goods and the quality of the environment. This kind of trade-off is usually depicted with the Engel curve in Figure 1. As income increases, budget constraints shift upwards, which allows both for an increase in consumption in general and a higher investment in environmental quality. Thus, as a population becomes wealthier, the demand for higher environmental quality should rise, which, in the aggregate, should result in a positive correlation between a country's wealth and its level of environmental concern. More specifically, it is often argued that the relation between wealth and environmental concern is not linear but concave (see Israel and Levinson, 2004). Thus, as environmental quality improves with wealth, individuals' marginal willingness to pay for environmental quality might decline again.

It is important to distinguish between individuals' marginal and overall willingness to pay. Total willingness to pay should increase with income, irrespective of changes in the amount of pollution, as depicted by the dashed line in Figure 2. In contrast, individuals' marginal willingness to pay should first increase as pollution increases with economic development and then decline when pollution decreases with more pollution control as depicted by the solid line in Figure 2. Furthermore, the inverted U-shaped form of marginal willingness to pay should be observed with respect only to local environmental quality. Empirical studies (e.g. Holtz-Eakin and Selden, 1992; Selden and Song, 1994; Grossman and Krüger, 1995; Ehrhardt-Martinez, Crenshaw and Jenkins, 2002; Antweiler, Copeland and Taylor, 2003) have confirmed the existence of the environmental Kuznets curve for regional air and water quality. But global environmental risks like energy consumption and related CO<sub>2</sub> emissions increase steadily with *per capita* GDP and are



**Figure 2** The environmental Kuznets curve and environmental concern

not related to income in the same inverted U-shaped form as other kinds of pollution (Khanna, 2002; York, Rosa and Dietz, 2003; Smith and Ezzati, 2005). Thus, with respect to global risks such as CO<sub>2</sub> emissions, not only total but also marginal willingness to spend money on pollution reduction should increase with income.

So far, we have focused on three distinct hypotheses, namely that environmental concern depends on wealth, that it depends on post-material values, and that wealth should not matter. Notice that all three hypotheses are applicable to the micro level of individuals as well as to the macro level of cross-national differences. The prosperity and the post-materialism hypothesis do not contradict each other. Both wealth as well as post-material values could contribute independently to environmental concern. However, Dunlap and Mertig's (1994, 1995) globalization thesis clearly contradicts both the prosperity as well as the post-materialism hypothesis since it postulates that cross-national differences cannot be explained by wealth or post-material values.

However, the level of environmental concern also depends on various other factors that have received little attention so far. Next to wealth itself, the distribution of wealth might influence the concern for the environment. High levels of income inequality could draw public attention more strongly to issues of economic development and redistribution than to environmental quality. Furthermore, the quality of the natural environment should make a difference. It is to be expected that citizens of countries with poor air and water quality or decreasing biodiversity and high soil degradation are more concerned with the state of the environment. However, in order for environmental quality to influence environmental concern, individuals must be able to assess the quality of the environment. This is not always possible, especially if pollutants are

not easily perceivable such as CO<sub>2</sub>. Therefore, more easily perceivable factors such as a region's or country's population density or the degree of urbanization might instead exert greater influence on individuals' evaluation of environmental quality than objective levels of pollution. Specifically, individuals living in more populous areas or larger cities might feel themselves to be confronted with environmental problems to a larger extent than those in more sparsely populated regions. And, although people may not be able to directly perceive processes such as resource overuse, energy consumption, and CO<sub>2</sub> emission, environmental concern should also depend on the belief or knowledge that these processes are taking place. Such knowledge is usually acquired through education, and thus a country's educational level should be positively linked to environmental concern.

Next to the macro level effects discussed so far, there are also individual level variables that are expected to influence environmental concern. Some attention has already been devoted to a number of sociodemographic effects such as age and gender (e.g. Van Liere and Dunlap, 1980; Greenbaum, 1995; Dietz, Stern and Guagnano, 1998). With respect to age, most studies report a negative relation to environmental concern, with young people expressing higher levels of concern. However, most studies examining this issue are based on cross-sectional data and therefore cannot distinguish between an age effect and a cohort effect. There is general agreement on the existence of a cohort effect, since environmental problems became topics of widespread discussion in the 1970s and 1980s, and birth cohorts from the 1950s and 1960s have therefore been more intensively exposed to this discussion than earlier cohorts. However, there may be an additional life-cycle effect. The relation between age and an individual's environmental concern should take on the same inverted U shape as the relation between age and voluntary political activity. Levels of political activity are usually found to be highest during middle age, while teenagers and the elderly are found to be more focussed on private as opposed to public concerns. Much attention has also been given to the gender effect. Empirical studies find that women display higher environmental concern than men even after controlling for their income or educational background (see Blocker and Eckberg, 1989, 1997; Davidson and Freudenburg, 1996; Wilson *et al.*, 1996; Bord and O'Connor, 1997; Zelezny, Chua and Aldrich, 2000).

Beside the already specified effect of post-material values, the literature has also spent some effort on the possible influence of more general values or religious

beliefs. With respect to the latter, empirical studies have not produced consistent results (Eckberg and Blocker, 1996; Dietz, Stern and Guagnano, 1998). Neither membership in any given religious denomination nor the intensity of religious participation seem to be linked to environmental concern. Among values, altruism is a plausible candidate for the association with concern for the environment (e.g. Axelrod, 1994; Stern and Dietz, 1994; Dietz, Fitzgerald and Shwom, 2005). However, we cannot test any hypotheses related to altruism or religious values, since such variables are not included in the ISSP's questions on environment.

To sum up, it is still an unresolved debate in environmental sociology how a nation's wealth as well as individual prosperity is related to environmental concern. While some studies assume and find positive associations, other studies deny them. In addition, further country specific variables such as the distribution of wealth or environmental quality has not been scrutinized in a cross-national perspective so far. In what follows, we submit the prosperity and post-materialism hypotheses, combined with other assumed determinants, to an empirical test by applying multi-level models to the ISSP data of 1993 and 2000. The ISSP has the advantage that it contains a comparatively thorough measurement of environmental attitudes and therefore does not rely only on one or two single indicators, as do other studies (e.g. Israel and Levinson, 2004; Gelissen, 2007). Moreover, the participating nations of the ISSP are particularly concerned with random sampling procedures, and further, reliable data are also available for the countries' other characteristics (e.g. GNP, environmental quality) needed for the analysis.

## The ISSP 1993 and 2000

In order to test the hypotheses discussed earlier, we analyse data from the International Social Survey Programme (ISSP) from the years 1993 and 2000. Table 1 lists the 26 countries that participated in the ISSP 2000, along with a few basic summary statistics for each of those countries. Environmental concern was measured in the two ISSP waves by the 11 items displayed in Table 2.<sup>1</sup>

First, we examined the content validity of these items. In the sociological literature (e.g. Maloney and Ward, 1973; Maloney, Ward and Braucht, 1975), environmental concern is often considered to consist of three components: a cognitive component, an affective component, and a conative (or intentional) component. To test whether these three dimensions

were adequately captured in our data, we submitted the 11 items from the ISSP 2000 to an explorative factor analysis (principal components method), which extracted three dimensions. The first dimension consists of items 1–4, has an eigenvalue of 2.7, and explains 22 per cent of the item variance. This factor clearly reflects the conative component of environmental concern. The four items measure the respondents' willingness to pay higher prices or higher taxes in order to protect the environment.

The second factor consists of items 5–9, has an eigenvalue of 1.9, and explains 18 per cent of item variance. Items 6 and 7 appear to capture an emotional concern about the quality of the environment and make up the affective component. Items 5, 8, and 9 could be said to represent the cognitive component. They would seem to reflect rational consideration of the likely influence of science, economy and the individual on environmental quality.

In other words, for these data, the factor analysis does not distinguish between the cognitive and affective dimensions. Finally, the factor analysis groups items 10 and 11 into a third factor with an eigenvalue of 1.2, which explains 13 per cent of item variance. However, according to the Kaiser–Meyer–Olkin measure of sampling adequacy (KMO), items 10 and 11 reach an anti-image correlation of only 0.60 (a mediocre value), while all others have a KMO between 0.70 and 0.83 (good to very good values). Thus, items 10 and 11 should actually be excluded from our factor analysis. Another indication for the inadvisability of including items 10 and 11 in the analysis is that an additive scale constructed from items 1–9 has a Cronbach's  $\alpha$  reliability of 0.69, which is better than the 0.62 reliability attained when the scale is constructed from all 11 items.

For the following analysis, we constructed an additive scale of items 1–9 and interpreted this as a measurement of individuals' environmental concern. An alternative method would be to separate the measure for environmental concern according to the two factors extracted by the factor analysis. However, combining the two factors into one scale or treating them as two separate dependent variables does not change the results of the bivariate or multivariate analysis substantially. We therefore present the results we obtained from the combined measure of environmental concern.<sup>2</sup>

The value of the additive index depends on the answers provided by the respondents on a five-point scale to each item.<sup>3</sup> Table 2 displays the proportion of respondents in the three largest economies—the United States, Japan, and Germany—who were



**Table 1** Countries participating in the ISSP 2000; mean of environmental concern, PPP, and real economic growth *per capita* from 1993 to 2000

Country	Mean environmental concern 2000	Mean environmental concern 1993	Sample size ISSP 2000 <sup>a</sup>	PPP in \$1000 in 2000 <sup>b</sup>	Percentage difference of real GDP per capita 1993–2000
Switzerland (ch)	30.6**	31.8	778	28.81	8.70
Japan (jp)	30.4	30.1	821	25.89	8.02
Netherlands (nl)	29.9**	30.7	1,024	27.14	22.31
Denmark (dk)	29.8	— <sup>c</sup>	844	29.28	20.29
Finland (fi)	29.5	—	1,108	25.49	33.47
Canada (ca)	29.0**	30.5	944	28.58	23.31
Sweden (se)	28.8	—	811	24.47	25.20
Austria (at)	28.7	—	661	27.96	17.64
New Zealand (nz)	28.7**	29.8	944	20.07	12.86
Norway (no)	28.6**	29.9	1,147	35.13	25.98
Ireland (ie)	28.3**	25.8	971	30.33	73.65
USA (us)	28.0**	28.7	966	34.34	20.10
Spain (es)	27.9	27.9	669	20.19	24.18
Great Britain (gb)	27.8	28.2	782	24.80	23.53
Slovenia (si)	27.7	27.7	770	16.61	35.32
Germany (de)	27.2**	28.4	1,125	26.07	12.44
Israel (il)	26.6**	27.6	1,117	21.44	19.58
Mexico (mx)	26.5	—	928	8.96	15.11
Northern Ireland	25.6**	27.4	507	—	—
Russia (ru)	25.2**	26.4	1,050	7.22	−7.71
Czech Republic (cz)	25.3	25.4	999	15.16	15.59
Chile (cl)	25.1	—	1,269	9.19	29.80
Philippines (ph)	24.5	24.6	1,083	3.94	12.45
Latvia (lv)	24.2	—	733	8.19	47.73
Portugal (pt)	23.1	—	750	17.31	22.50
Bulgaria (bg)	22.9**	24.2	589	6.23	−4.29
<b>Mean</b>	<b>27.5**</b>	<b>28.5</b>		<b>20.91</b>	<b>21.51%</b>
<b>Total N</b>			<b>23,390</b>		

<sup>a</sup>Only respondents with a valid nine-item index of environmental concern, i.e. those who provided all nine answers contained in the index.

<sup>b</sup>PPP = purchasing power parity per capita in thousands of US\$, which measures each country's purchasing power in US Dollar.

<sup>c</sup>No data available.

\*\*Differences in environmental concern statistically significant at the 1 per cent level. The international comparison of mean concern covers countries with valid measures of environmental concern in both 1993 and 2000.

strongly or fairly willing, or who agreed strongly or fairly strongly with the items, in the years 1993 and 2000. In 2000, 45 per cent of respondents in the United States were very or fairly willing to pay higher prices for environmental protection. The willingness to pay higher taxes or accept a reduction in the standard of living was expressed by roughly a third of the respondents, and 51 per cent agreed that they would be willing to better protect the environment even if it meant paying higher prices or investing more time. Correspondingly, roughly half of the respondents disagreed with items 5–9, indicating that they did

not believe there was too much concern about the environment or too little for the economy. Overall, the level of expressed environmental concern in the United States was as high as in Germany, but lower than in Japan.

However, in all three countries, these values reflected lower concern for the environment than had been expressed in the ISSP survey in 1993.

Table 1 contains all countries that participated in the ISSP 2000. Countries are listed according to the mean environmental concern their respondents expressed in 2000. Inspection of this table and of

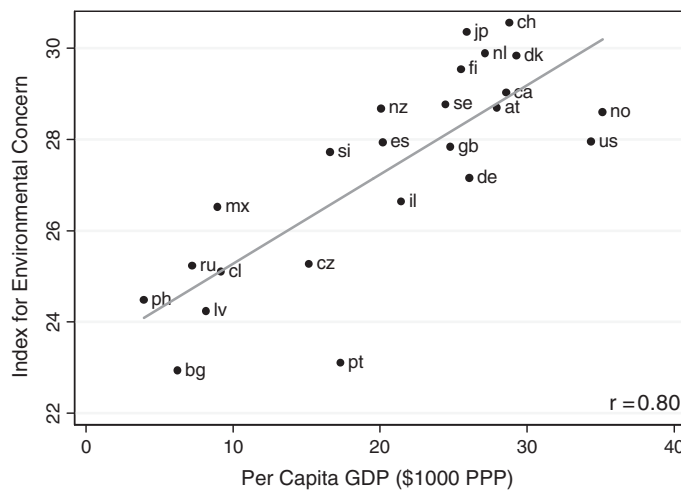
**Table 2** Environmental concern in the United States, Japan and Germany

	Percentage Agreement/disagreement					
	USA		Japan		Germany	
	1993	2000	1993	2000	1993	2000
How willing would you be to pay much higher prices in order to protect the environment? (% very and fairly willing)	52	45**	53	53	39	32**
How willing would you be to pay much higher taxes in order to protect the environment? (% very and fairly willing)	40	32**	44	37**	26	18**
How willing would you be to accept cuts in your standard of living in order to protect the environment? (% very and fairly willing)	34	29**	44	41	47	37**
I do what is right for the environment, even when it costs more money or takes more time. (% very and fairly willing)	57	51**	60	53**	57	54*
Modern science will solve our environmental problems with little change to our way of living. (% strong and fairly strong disagreement)	59	48**	75	76	43	43
We worry too much about the future of the environment and not enough about prices and jobs. (% strong and fairly strong disagreement)	44	44	48	47	46	48
People worry too much about human progress harming the environment. (% strong and fairly strong disagreement)	50	49	49	51	55	48**
In order to protect the environment the country needs economic growth. (% strong and fairly strong disagreement)	26	25	17	18	31	26**
It is just too difficult for someone like me to do much about the environment (% strong and fairly strong disagreement)	60	51**	56	56	49	53*
Almost everything we do in modern life harms the environment. (% strong and fairly strong agreement)	52	46**	52	51	56	49**
Economic growth always harms the environment. (% strong and fairly strong agreement)	21	19	60	49**	46	30**
Number of cases <sup>a</sup>	1,450	1,150	1,150	1,050	2,000	1,400
Mean of the index for environmental concern <sup>b</sup>	28.7	28.0**	30.1	30.4	28.4	27.2**
Standard deviation of the index for environmental concern	5.6	5.4	5.8	5.2	6.1	5.2
Cronbach's $\alpha$ of the index for environmental concern	0.76	0.73	0.71	0.66	0.74	0.66

Notes: A factor analysis classifies the items into two groups: Items 1–4 express the conative component of environmental concern. The second factor encompasses the affective (Items 6 and 7) and the cognitive components (Items 5, 8, and 9). Items 10 and 11 correlate partly negatively with the other items and, according to the Kaiser–Meyer–Olkin criterion, should not be included in the factor analysis. The additive index for environmental concern contains Items 1–9. The actual item ordering in the questionnaire was 5, 6, 10, 7, 8, 11, 1, 2, 3, 9, 4. The values reported reflect the proportion of respondents who (dis)agree or strongly (dis)agree with the statements. The bivariate significance tests for differences within countries between the 1993 and 2000 answers refer to a  $\chi^2$ -test: \*Significant at the 5 per cent level, \*\*Significant at the 1 per cent level.

<sup>a</sup>The number of cases may vary slightly by question.

<sup>b</sup>Values of the index of environmental concern range from 9 to 45. The mean difference is statistically significant at the 1 per cent level for Germany and the USA. A Kolmogorov–Smirnov test leads to the same results.



**Figure 3** The correlation between environmental concern and wealth

Figure 3 reveals that wealth is positively correlated with environmental concern. The highest levels of environmental concern are observed in countries with high levels of *per capita* purchasing power-adjusted GDP [purchasing power *per capita* (PPP)] such as Switzerland, Japan, and the Netherlands. Low levels can be observed in countries like Latvia, Portugal, and Bulgaria. A simple correlation of a country's *per capita* PPP and environmental concern results in a strong Pearson correlation of  $r=0.80$  and echoes results reported elsewhere (Diekmann and Franzen, 1999; Franzen, 2003).

In order to investigate non-GDP influences on environmental concern as well, we constructed a hierarchical linear regression model [see Snijders and Bosker (1999)]. This model attempts to explain individuals' environmental concern using both individual characteristics (level 1) and more general country-level variables (level 2). The model we estimate first is a random intercept model in which the total variance of environmental concern ( $Y_{ij}$ ) depends on the individual characteristics of the  $i$  through  $n$  individuals. Additionally, the intercept depends on the characteristics of the  $j$  through  $k$  countries:

$$Y_{ij} = \beta_{0j} + \beta_1 x_{1ij} + \dots + \beta_7 x_{7ij} + \varepsilon_{ij} \quad (1)$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} z_{1j} + \dots + \gamma_{07} z_{7j} + \zeta_{0j}$$

On the individual level, environmental concern is expected to depend on income, education, age, sex, and post-materialistic value orientation in the ways described in 'The Origin of Environmental Concern' section. We also assume that several macro-level variables exert an influence on individual-level

environmental concern as well. In addition to the postulated positive effect of the PPP, environmental concern might also depend on a country's distribution of that wealth. We therefore included the countries' income inequality (as operationalized by their Gini coefficients) in the model as well, assuming that higher inequality (i.e. a higher Gini coefficient) would be associated with lower concern. Finally, environmental concern should also depend on the state of the environment. All other things being equal, low environmental quality should increase respondents' need and preference for a better environment.

We operationalized environmental quality using data from the Environmental Sustainability Index 2001.<sup>4</sup> We use only those components of the index that are concerned with directly assessing a country's air and water quality as well as biodiversity and soil degradation. We also include two alternative measures, namely population density (number of inhabitants per square kilometer living in a country) and the degree of urbanization (the proportion of a country's inhabitants living in cities). As described earlier, high-population density might highlight the potential conflict between economic growth and the quality of the environment, so that people in densely populated countries may be more concerned with the state of the environment. Similarly, inhabitants of cities might be more aware of harmful anthropogenic effects on the environment, so that there should, on average, be more concern in countries with a higher degree of urbanization. However, direct confrontation with environmental problems is not the only factor that could produce the awareness of greater environmental problems.



Education and knowledge sensitize individuals to environmental problems as well. Therefore, we included an indicator for educational participation from the United Nations Human Development Report, since educating a larger proportion of the population might have spillover effects on those individuals with less education. Widespread post-materialistic value orientations might exert an analogous effect on the environmental concern of even those citizens with fewer post-materialistic values.

The results of the multilevel regression analyses are presented in Table 3. The first two columns display the results using the ISSP 1993, and models 3 and 4 show the results obtained from the ISSP 2000 data. A first inspection of Table 3 reveals that most results are similar independently of the data sets used or the different models estimated. This holds true despite the fact that both data sets consist of different random samples drawn in 1993 and 2000 and despite the set of countries not being the same (see Table 1).<sup>5</sup> All independent variables included in the analysis refer to the year 1993 for models 1 and 2 and to the year 2000 in models 3 and 4. Let us first turn to the macro level effects. Results of model 1 suggest that individuals' environmental concern increases by almost 0.2 units on the environmental concern index with every increase in *per capita* PPP of US\$ 1,000. This effect is robust no matter whether we use the 1993 or the 2000 data, even though the effect is somewhat weaker in the 2000 data. Notice that in both data sets none of the other macro variables included in model 1 (or model 3 for the ISSP 2000) are statistically significant. Thus, neither a country's income inequality, nor its educational participation, or proportion of post-materialists, or environmental quality, or population density or proportion of urban population influence the environmental concern of its citizens.<sup>6</sup> Hence, we do not find any spillover effects of education or the general level of post-materialistic values, and the only significant macro level effect found is the *per capita* PPP.<sup>7</sup> We therefore dropped all insignificant macro variables from the analyses in models 2 and 4.<sup>8</sup>

Next, we discuss the individual level effects. Here too, the results do not differ substantially between the ISSP 1993 and the ISSP 2000 or between the models including all macro variables (models 1 and 3) and the more simple models 2 and 4. On the individual level, income and education have positive effects on environmental concern, as expected. Income is operationalized by household income adjusted for household size.<sup>9</sup> Since income is reported in different currencies in the different countries, we z-transformed the income variable (assigning a mean of 0 and a

standard deviation of 1) to produce a country-specific measure of relative individual income. An increase in the respondents' household income of one standard deviation from the country's mean increases respondents' values on the index of environmental concern (which ranges in value from 9 to 45) by roughly half of a point (see models 2 and 4). Education is measured in the number of years respondents spent in school. The results indicate that every year of additional schooling increases an individual's environmental concern by 0.23 index units (or 0.18 for the ISSP 2000). Post-materialistic values also increase environmental concern independently of income and education. The ISSP measures the post-materialistic value orientation according to Inglehart's suggestion by asking participants for the highest and second highest priority a respondent's country should follow. Individuals can opt for no post-materialistic priorities, for one or for two post-materialistic priorities (either to protect freedom of speech or giving people more say in government decisions or both).<sup>10</sup> The results indicate that for every additional preference of a post-materialistic goal, environmental awareness increases by almost one unit on our concern index. Furthermore, we find that women have higher levels of environmental concern and that environmentalism declines with age.<sup>11</sup> In addition, the models include a measure of individuals' environmental knowledge and a measure of individuals' subjective perception of environmental quality.<sup>12</sup> Not surprisingly, the more individuals know about environmental problems, the higher their concern. This effect is relatively strong but does not eliminate the effect of the general level of education. The subjective perception of the condition of the local environmental condition also affects environmental concern: the worse the perceived quality of the environment, the higher the environmental concern. Again, both effects are rather similar in the different models and can thus be considered robust findings.

Models 2 and 4 differ from models 1 and 3 in that they test for non-linearity and interaction effects between micro and macro level variables. According to the results of this analysis, the effect of individual income is not linear but concave, as environmental concern increases to a marginally declining degree with income. In contrast, the effects of post-materialistic values and education are convex. The marginal increase in environmental concern increases at higher levels of post-materialistic value orientations. However, this result holds only for the ISSP 2000 data but not for the 1993 data. The shape of the effect of education differs between the two data sets. In the ISSP 1993, education has an exponential effect on environmental

**Table 3** Determinants of environmental concern (multilevel regression) using the ISSP 1993 and 2000

	1993 Model 1	1993 Model 2	2000 Model 3	2000 Model 4
Constant	8.891** (2.378)	11.065** (1.027)	10.714** (3.693)	14.942** (0.776)
<i>Country-level variables</i>				
Per capita PPP	0.195* (0.084)	0.236** (0.054)	0.122* (0.062)	0.162** (0.031)
Gini coefficient	2.000 (6.110)		−2.024 (2.872)	
Educational participation			0.010 (0.037)	
Proportion post-materialists	0.020 (0.032)		0.058 (0.036)	
Environmental quality			0.080 (1.014)	
Proportion urban population	−0.011 (0.033)		−0.018 (0.026)	
Population density	0.003 (0.003)		0.001 (0.003)	
<i>Individual-level variables</i>				
Relative income within country	0.396** (0.040)	0.595** (0.052)	0.426** (0.040)	0.545** (0.052)
Individual post-materialism	1.252** (0.067)	0.968** (0.195)	1.191** (0.066)	0.866** (0.167)
Sex (1 = female)	0.321** (0.078)	0.320** (0.078)	0.368** (0.076)	0.367** (0.076)
Age/10	−0.201** (0.026)	−0.204** (0.027)	−0.121** (0.025)	−0.144** (0.025)
Years of education	0.234** (0.014)	0.057 (0.060)	0.180** (0.012)	−0.145** (0.042)
Knowledge about environment	0.357** (0.019)	0.346** (0.019)	0.247** (0.019)	0.229** (0.019)
Perceived environmental quality	0.254** (0.006)	0.253** (0.006)	0.181** (0.006)	0.178** (0.006)
<i>Non-linearity</i>				
Equivalence income <sup>2</sup>		−0.136** (0.022)		−0.070** (0.016)
Post-materialism <sup>2</sup>		0.118 (0.086)		0.202* (0.084)
Years of education <sup>2</sup>		0.008** (0.003)		0.016** (0.002)
<i>Cross-level effects</i>				
Per capita PPP × post-materialism		0.022 (0.021)		0.036** (0.008)
Number of cases	15,618	15,618	15,656	15,656
var(Residual): <i>Individual level</i>	23.269	23.108	22.01	21.830
var(Constant): <i>Country level</i>	1.435	1.921	1.687	1.725
var(Postmaterialism):		0.192		0.034
cov(Postmaterialism, Constant)		−0.302		1.169
Log-Likelihood	−46773.8	−46731.3	−46462.5	−46401.5
<i>Explained variance intercept</i>				
<i>Individual level</i>	0.184	0.190	0.156	0.163
<i>Country level</i>	0.700	0.593	0.638	0.630

Notes: The effects reported are unstandardized. The values in brackets contain the standard errors of the estimation. Superscript '2' refers to the square of the variable. \*Significant at the 5 per cent level, \*\*Significant at the 1 per cent level. Models 1 and 3 are random intercept models. Models 2 and 4 are random slope models.

concern. In the ISSP 2000, concern first decreases with education until respondents reach on average 4.5 years of education, after which additional education increases environmental concern. However, since the results differ between the two surveys its functional form should not be over-interpreted. We also tested for a number of possible cross-level effects and obtained one statistical significant result. The positive effect of post-materialist values becomes stronger the richer the country of the respondents. Again, this finding shows up only in the 2000 data but not in the 1993 data and might therefore not be a robust result.<sup>13</sup>

Overall, the so-called null model of the hierarchical linear model (not shown here) indicates that 85 per cent of the total variance in observed individual-level environmental concern is due to within-country variance. Only the remaining 15 per cent is due to between-country variance. This means that the differences observed among individuals within a country are much larger than the differences observed between countries in terms of the average level of concern. On the macro level, 63 per cent of the variance can be explained by a single factor, the *per capita* PPP. On the individual level, only 16 per cent of the variance can be explained by all of our micro level determinants. Thus, the between-country differences are relatively well explained by differences in wealth. However, the reasons for the differences in concern among individuals in any given country remain relatively unclear.

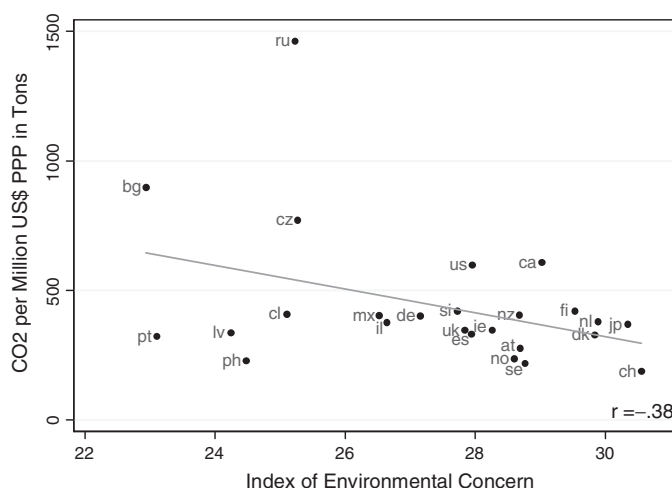
## Discussion and Conclusions

Our multilevel analysis of the ISSP 1993 and 2000 demonstrates that individuals' concern for the environment varies between countries and within countries. The within-country differences are much larger (85 per cent of the total variance) than the between-country differences (15 per cent of the total variance). The between-country differences are best explained by the countries' wealth as measured by the purchasing-power-adjusted *per capita* GDP. Hence, on average, populations in richer countries have higher levels of environmental concern than inhabitants of poorer nations. The single-wealth indicator explains 63 per cent of the observed between-country differences. This finding supports the prosperity hypothesis and argues against the globalization hypothesis or the post-materialism hypothesis. However, individuals' environmental concern does not only depend on the macro context but predominately on individual characteristics. Thus, environmental concern depends on the relative income position within the country.

Individuals who live in a relatively high-income household—as measured by the deviation from a country's mean income—report higher concern for the environment than individuals in households with relatively lower income. In addition, this individual effect confirms the prosperity assumption, which states that individuals' total concern or total willingness to pay for environmental quality increases with income. Furthermore, concern for the environment also depends on individuals' post-materialistic attitudes. Post-materialists express more concern for the environment than materialists. Moreover, individuals' environmental concern also depends on their education, knowledge about the environment and the perceived environmental burden. However, we also have to point out that the 26 countries that participated in the ISSP are not a random sample of all nations. Specifically, two-third of them are members in the OECD and only one-third are developing nations. This selectivity should be kept in mind when attempting to generalize the macro level findings. However, the country-specific samples are random samples, and the individual level results presented should be fairly robust.

Investigations of environmental concern often ask whether, and to what extent, this concern relates to environmental behaviour. Studies on the individual level are rather pessimistic in this regard and show that environmental concern translates into behaviour only if the behaviour is not cost intensive, as for example in the case of recycling. More costly actions, such as saving energy and choosing public transport, depend more on material incentives than on pro-environmental attitudes (Derksen and Gartell, 1993; Diekmann and Preisendörfer, 1998, 2003; Stern, 1999). However, in democracies, a high level of environmental concern should translate into more pro-environmental governmental regulations. Voters with higher environmental concern should support political parties that favour ecological policies, and governmental regulations should therefore be more accepted in countries with higher levels of environmental concern. Economic development and wealth are, of course, related to higher levels of production and should thus create higher absolute levels of energy consumption and accompanying CO<sub>2</sub> emissions as well. However, 'green' countries should have higher energy efficiency. This assumption is supported by our data (see Figure 4).

The correlation between the average environmental concern expressed by a country's residents and its CO<sub>2</sub> emission per million US dollars of PPP is  $-0.38$  and is statistically significant at the 10 per cent level. In other words, the higher the environmental concern, the



**Figure 4** Environmental concern and CO<sub>2</sub> emissions per unit of GDP

lower the CO<sub>2</sub> emissions per unit of goods and services produced. However, this finding is based on data from only 24 countries and should be interpreted with appropriate care. The correlation depends on single countries and the ecological efficiency of an economy most likely also depends on its state of development. Specifically, the tertiary service sector accounts for a larger share of the economy in more developed countries. This sector is often assumed to consume less energy than the industrial sector. We would therefore expect that energy consumption—and, along with it, CO<sub>2</sub> emissions per units of GDP—declines with increasing levels of GDP. This assumption is also supported by our data. The correlation between PPP and CO<sub>2</sub> emissions per 1 million US\$ is  $-0.39$ . However, the negative relation of environmental concern and CO<sub>2</sub> emissions remains even if we control for the level of wealth (i.e. for *per capita* PPP) in an OLS regression (results not shown). These are only preliminary findings and they are not very robust due to the small number of cases. However, they suggest that the level of environmental concern of a society in fact does influence its environmental behaviour. Thus, the maintenance or even increase of environmental concern seems to be a crucial component for environmental protection.

## Notes

1. The ISSP 2000 contains three additional items linked to environmental concern that were not included in the ISSP 1993. For comparative purposes, we restricted the measures of

environmental concern analysed here to those 11 items contained in both surveys. However, none of the results of the analysis of the ISSP 2000 change if those three items are included.

2. Results for the separate analyses are available from the authors upon request. We also conducted a factor analysis with oblique rotation, which allows for factors to be correlated. The correlation we obtained is 0.27.
3. Either 'very willing', 'fairly willing', 'neither willing nor unwilling', 'fairly unwilling', 'very unwilling' or 'strongly agree', 'agree', 'neither agree nor disagree', 'agree', 'strongly disagree'.
4. The index stems from the Yale Center for Environmental Law and Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) of Columbia University and was constructed in collaboration with the World Economic Forum and the Joint Research Centre of the European Commission.
5. The ISSP 1993 contains also four countries, Australia, Hungary, Italy, and Poland, that did not participate anymore in 2000.
6. We could not obtain reliable data on some countries' proportion of educational participation and environmental quality for 1993. These two variables are therefore not included in the analysis of the ISSP 1993.
7. To avoid multicollinearity, we ran different regression models that included PPP and only one further macro variable. However, none of

these variations changed the estimation results presented in Table 3.

8. We also conducted an intensive outlier analysis by excluding some countries (e.g. Bulgaria or Portugal) and re-estimating the model. However, none of these variations changed our results substantially.
9. The so-called equivalence income is calculated by summing all reported incomes of individuals living in one household and dividing this sum by the square root of the number of individuals living in the household.
10. See 'Appendix' section for the exact question wording of the Inglehart (1990) index.
11. We also estimated all models including employment status (employed versus not employed), marital status (married versus not married), and household size even though we did not expect them to have specific effects on environmental concern. Since we obtained no statistically significant results, we did not include these variables in our final estimation depicted in models 1–4.
12. The measurement of both scales is documented in the 'Appendix'.
13. Models 2 and 4 are random slope models which allow for different slopes of specific variables (in our case, the individual post-materialistic attitudes).

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## References

- Antweiler, W., Copeland, B. R. and Taylor, S. M. (2003). Is Free Trade Good for the Environment? *American Economic Review*, **91**, 877–908.
- Axelrod, L. J. (1994). Balancing Personal Needs with Environmental Preservation: Identifying the Values that Guide Decisions in Ecological Dilemmas. *Journal of Social Issues*, **50**, 85–104.
- Baumol, W. J. and Oates, W. E. (1979). *Economics, Environmental Policy, and the Quality of Life*. Englewood Cliffs, NJ: Prentice Hall.
- Blocker, T. J. and Eckberg, D. L. (1989). Environmental Issues as Women's Issues: General Concerns and Local Hazards. *Social Science Quarterly*, **70**, 586–593.
- Blocker, T. J. and Eckberg, D. L. (1997). Gender and Environmentalism: Results from the 1993 General Social Survey. *Social Science Quarterly*, **78**, 841–858.
- Bord, R. J. and O'Connor, R. E. (1997). The Gender Gap in Environmental Attitudes: The Case of Perceived Vulnerability to Risk. *Social Science Quarterly*, **78**, 830–840.
- Davidson, D. J. and Freudenburg, W. R. (1996). Gender and Environmental Risk Concerns: A Review and Analysis of Available Research. *Environment and Behavior*, **28**, 302–339.
- Derksen, L. and Gartrell, J. (1993). The Social Context of Recycling. *American Sociological Review*, **58**, 434–442.
- Diekmann, A. and Franzen, A. (1999). The Wealth of Nations and Environmental Concern. *Environment and Behavior*, **31**, 540–549.
- Diekmann, A. and Preisendörfer, P. (1998). Environmental Behavior: Discrepancies between Aspiration and Reality. *Rationality and Society*, **10**, 79–102.
- Diekmann, A. and Preisendörfer, P. (2003). Green and Greenback. The Behavioral Effects of Environmental Attitudes in Low-Cost and High-Cost Situations. *Rationality and Society*, **15**, 441–472.
- Dietz, T., Fitzgerald, A. and Shwom, R. (2005). Environmental Values. *Annual Review of Environment and Resources*, **30**, 335–372.
- Dietz, T., Stern, P. C. and Guagnano, G. A. (1998). Social Structural and Social Psychological Bases of Environmental Concern. *Environment and Behavior*, **30**, 450–471.
- Dunlap, R. E., Gallup, G. H. and Gallup, A. M. (1993). Of Global Concern: Results of the Health of the Planet Survey. *Environment*, **35**, 7–15, 33–39.
- Dunlap, R. E. and Jones, R. E. (2002). Environmental Concern: Conceptual and Measurement Issues. In Dunlap, R. and Michelson, W. (Eds.), *Handbook of Environmental Sociology*. Westport: Greenwood Press, pp. 482–524.
- Dunlap, R. and Mertig, A. G. (1994). Global Environmental Concern. A Challenge to the Post-Materialism Thesis. Paper presented at the XIII. World Congress of Sociology in Bielefeld, Mimeo.
- Dunlap, R. and Mertig, A. G. (1995). Global Concern for the Environment: Is Affluence a Prerequisite? *Journal of Social Issues*, **51**, 121–137.
- Dunlap, R. and Mertig, A. G. (1997). Global Environmental Concern: An Anomaly for Postmaterialism. *Social Science Quarterly*, **78**, 24–29.
- Dunlap, R. and Van Liere, K. (1978). The New Environmental Paradigm. A Proposed Measuring Instrument and Preliminary Results. *The Journal of Environmental Education*, **9**, 10–19.



- Eckberg, D. L. and Blocker, T. J. (1996). Christianity, Environmentalism, and the Theoretical Problem of Fundamentalism. *Journal for the Scientific Study of Religion*, **35**, 343–355.
- Ehrhardt-Martinez, K., Crenshaw, E. M. and Jenkins, J. C. (2002). Deforestation and the Environmental Kuznets Curve: A Cross-National Investigation of Intervening Mechanisms. *Social Science Quarterly*, **83**, 226–243.
- Field, B. C. (1994). *Environmental Economics: An Introduction*. New York: McGraw-Hill.
- Franzen, A. (2003). Environmental Attitudes in International Comparison: An Analysis of the ISSP Surveys 1993 and 2000. *Social Science Quarterly*, **84**, 297–308.
- Gelissen, J. (2007). Explaining Popular Support for Environmental Protection: A Multilevel Analysis of 50 Nations. *Environment and Behavior*, **39**, 392–415.
- Greenbaum, A. (1995). Taking Stock of Two Decades of Research on the Social Basis of Environmental Concern. In Metha, M. D. and Quellet, E. (Eds.), *Environmental Sociology*. North York: Captus Press, pp. 125–152.
- Grossman, G. M. and Krüger, A. B. (1995). Economic Growth and the Environment. *The Quarterly Journal of Economics*, **110**, 353–377.
- Holtz-Eakin, D. and Selden, T. M. (1992). Stoking the Fires? CO<sub>2</sub> Emissions and Economic Growth. *NBER Working Papers* 4248.
- Ingelhart, R. (1990). *Culture Shift in Advanced Industrial Society*. Princeton, NJ: Princeton University Press.
- Ingelhart, R. (1995). Public Support for Environmental Protection: Objective Problems and Subjective Values in 43 Societies. *Political Science and Politics*, **28**, 57–72.
- Ingelhart, R. (1997). *Modernization and Postmodernization: Cultural, Economic, and Political Change in 43 Societies*. Princeton, NJ: Princeton University Press.
- Israel, D. and Levinson, A. (2004). Willingness to Pay for Environmental Quality: Testable Empirical Implications of the Growth and Environment Literature. *Contributions to Economic Analysis and Policy*, **3**, 1–29.
- Kemmelmeier, M., Król, G. and Kim, Y. H. (2002). Values, Economics and Pro-environmental Attitudes in 22 societies. *Cross-Cultural Research*, **36**, 256–285.
- Khanna, N. (2002). The Income Elasticity of Non-point Source Air Pollutants: Revisiting the Environmental Kuznets Curve. *Economics Letters*, **77**, 387–392.
- Maloney, M. P. and Ward, M. P. (1973). Ecology: Let's Hear from the People: An Objective Scale for the Measurement of Ecological Attitudes and Knowledge. *American Psychologist*, **28**, 583–586.
- Maloney, M. P., Ward, M. P. and Braucht, N. G. (1975). A Revised Scale for the Measurement of Ecological Attitudes and Knowledge. *American Psychologist*, **30**, 787–790.
- Meadows, D. H., & Meadows, D. (1972). *The Limits of Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. London: Universe Publications.
- Selden, T. M. and Song, D. (1994). Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions? *Journal of Environmental Economics and Management*, **27**, 147–162.
- Smith, K. R. and Ezzati, M. (2005). How Environmental Health Risks Change with Development: The Epidemiologic and Environmental Risk Transition Revisited. *Annual Review of Environment and Resources*, **30**, 291–333.
- Snijders, T. A. B. and Bosker, R. J. (1999). *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modelling*. London: Sage.
- Stern, P. C. (1999). Information, Incentives and Pro-environmental Consumer Behavior. *Journal of Consumer Policy*, **22**, 461–468.
- Stern, P. C. and Dietz, T. (1994). The Value Basis of Environmental Concern. *Journal of Social Issues*, **50**, 65–84.
- Van Liere, K. and Dunlap, R. E. (1980). The Social Basis of Environmental Concern: A Review of Hypotheses, Explanations, and Empirical Evidence. *Public Opinion Quarterly*, **44**, 181–197.
- Wilson, M. et al. (1996). Sex Differences in Valuations of the Environment? *Population and Environment*, **18**, 143–159.
- York, R., Rosa, E. A. and Dietz, T. (2003). Footprints on Earth: Environmental Consequences of Modernity. *American Sociological Review*, **68**, 279–300.
- Zelezny, L., Chua, P.-P. and Aldrich, Ch. (2000). Elaborating on Gender Differences in Environmentalism. *Journal of Social Issues*, **56**, 443–457.

## Authors' Addresses

Axel Franzen (to whom correspondence should be addressed), Institute of Sociology, University of Cologne, Greinstr. 2, 50939 Cologne, Germany. Email: franzen@wiso.uni-koeln.de

Reto Meyer, Institute of Sociology, ETH Zurich, Scheuchzerstr. 70, 8092 Zurich, Switzerland.



## Appendix A1: Description of the variables

Variable	Min.	Max.	Description	Data source	Reference
<i>Country variables</i>					
Per capita PPP	3.9	35.1	Per capita GDP 2000 converted to measure the purchasing power in each country, in 1,000s of US\$.	International Monetary Fund: World Economic Outlook Database	<a href="http://www.imf.org/external/pubs/ft/weo/2005/01/data/dbgnim.cfm">http://www.imf.org/external/pubs/ft/weo/2005/01/data/dbgnim.cfm</a> (13 March 2007)
Gini coefficient	0.22	0.68	Measures income inequality 0 = equal distribution, 1 = maximally unequal distribution.	Authors' own calculation with ISSP data	
Educational participation	70	106	Combined primary, secondary and tertiary gross enrolment ratio (%), 1999	United Nations Development Program: Human Development Report 2002	<a href="http://hdr.undp.org/reports/global/2002/en/pdf/backone.pdf">http://hdr.undp.org/reports/global/2002/en/pdf/backone.pdf</a> (13 March 2007)
Post-materialism	37.6	85.4	Proportion of persons with at least one post-materialistic item reported as a priority for the country, item battery from Inglehart (1990)	Author's own calculation with ISSP data	Inglehart (1990)
Environmental quality	-0.77	1.36	Part of the Environmental Sustainability Index 2001 (Environmental Systems Component), measures the condition of the environment in the following sectors: air quality, water quality, amount of water, biodiversity and terrestrial systems. Mean of these five sectors. Before added, the items for the individual sectors are z-transformed.	YCELP, CIESIN, WEF and the Joint Research Centre of the European Commission	<a href="http://sedac.ciesin.columbia.edu/es/esi/archive.html">http://sedac.ciesin.columbia.edu/es/esi/archive.html</a> (13 March 2007)
Proportion urban population	50.8	91.5	Population living in areas classified as urban according to the criteria used by each area or country. Data refer to 1st of July of the year indicated and are presented in thousands.	United Nations: World Population Prospects	<a href="http://esa.un.org/unpp/index.asp?panel=1">http://esa.un.org/unpp/index.asp?panel=1</a> (13 March 2007)
Population density	3	383	Number of inhabitants per square kilometer of land.	United Nations: World Population Prospects	<a href="http://esa.un.org/unpp/index.asp?panel=1">http://esa.un.org/unpp/index.asp?panel=1</a> (13 March 2007)
CO <sub>2</sub> per GDP in purchasing power parity	186	1461	Carbon dioxide emissions per GDP in PPP for 2000. Average amount of carbon dioxide (CO <sub>2</sub> ) emitted per unit of income generated by a country's economy. CO <sub>2</sub> emissions from land use change, biomass fuels, and cement manufacture are not included here. Data are reported in metric tons of CO <sub>2</sub> per million international dollars.	World Resources Institute: Earth Trends Database	<a href="http://earthtrends.wri.org/searchable_db/index.php?theme=3">http://earthtrends.wri.org/searchable_db/index.php?theme=3</a> (13 March 2007)
<i>Individual variables</i>					
Relative income within country	-1.92	11.67	Household income excluding the highest and lowest percent divided by the square root of the number of persons living in the household, z-transformed.		
Post-materialism	0	2	Number of reported post-materialistic items reported as a priority for the country, item battery from Inglehart (1990)		
Sex	0	1	0 = male, 1 = female		
Age in years	18	85	Age in years		
Years of education	0	18	Years of education		
Household size	1	18	Number of persons living in the household		

**Appendix A2:** Measure of environmental knowledge: index of six Items

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Antibiotics can kill bacteria but not viruses. (correct)	1 = correct, 0 = incorrect
Human beings developed from earlier species of animals. (correct)	1 = correct, 0 = incorrect
All man-made chemicals can cause cancer if you eat enough of them. (incorrect)	1 = correct, 0 = incorrect
If someone is exposed to any amount of radioactivity, they are certain to die as a result. (incorrect)	1 = correct, 0 = incorrect
The greenhouse effect is caused by a hole in the earth's atmosphere. (incorrect)	1 = correct, 0 = incorrect
Every time we use coal or oil or gas, we contribute to the greenhouse effect. (correct)	1 = correct, 0 = incorrect

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*The answer, 'don't know' was coded as 'incorrect'. To prevent the loss of cases due to missing values for some of the questions, the additive index was divided by the number of valid items and multiplied by 10 for the multilevel models.*

**Appendix A3:** Measure of perceived environmental burden: index of six Items**'In General, what do you think, how dangerous these things are?'**


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...air pollution caused by cars.	(5) extremely dangerous for the environment
...air pollution caused by industry.	(4) very dangerous for the environment
...pesticides and chemicals used in farming.	(3) somewhat dangerous for the environment
...pollution of the country's rivers, lakes and streams.	(2) not very dangerous for the environment
...a rise in the world's temperature caused by the greenhouse effect.	(1) not dangerous at all for the environment
...modifying the genes of certain crops.	

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*To prevent the loss of cases due to missing values for some of the questions, the additive index was divided by the number of valid items and multiplied by 10 for the multilevel models.*

**Appendix A4:** Measure of post-materialism in the ISSP 2000**'Looking at the list below, please tick a box next to the one thing you think should be your country's highest priority'**


---

1. Maintain order in the nation	(Please tick one box only)
2. Give people more say in government decisions	
3. Fight rising prices	
4. Protect freedom of speech	

---

**'And which one do you think should be your country's next highest priority, the second most important thing it should do?'**


---

1. Maintain order in the nation	(Please tick one box only)
2. Give people more say in government decisions	
3. Fight rising prices	
4. Protect freedom of speech	

---

*Respondents can mark no, one or two post-materialist items (items 2 and 4).*