



Is environment 'a city thing' in China? Rural–urban differences in environmental attitudes



Xueying Yu*

School of Economics and Management, Beihang University, 37 Xueyuan Road, Beijing 100191, China

ARTICLE INFO

Article history:

Available online 6 January 2014

Keywords:

Environmental attitudes
Rural–urban difference
China

ABSTRACT

With the rise of environmentalism in China, great efforts have been devoted to understanding Chinese people's environmental attitudes. Past scholarship has established a contour for describing and analyzing these attitudes, but this research remains constrained by limited samples that neglect rural people. Using a rural–urban combined sample, this study comprehensively evaluates rural people's environment attitudes and compares them to those of urban residents. The results indicate that rural Chinese are less concerned about the environment than their urban counterparts, especially when it comes to the issues of pollution, nature conservation, and global environmental degradation. Instead, they tend to focus on problems directly related to agricultural production. Such relatively passive stances on environmental protection are in part due to limited education and a lack of access to environmental information in rural regions of China. In order to build rural communities resistant to environmental degradation, it is imperative to strengthen environmental education.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Over the past several decades, China has risen to global prominence as an economic power, but the country's booming economy has brought with it some of the most serious environmental problems on the planet. China is now the largest emitter of SO₂ and CO₂, and roughly 70% of China's fresh water is polluted by lightly regulated industries (Gao, Yin, Ai, & Huang, 2009; Guan, Peters, Weber, & Hubacek, 2009; Ma, 2004). Environmental degradation is rapidly accelerating in China, raising serious concerns about the hidden costs of economic growth. A World Bank estimate shows that air and water pollution have created significant health problems that are costing the country between 1.2% and 3.8% of its Gross Domestic Product (World Bank, 2007).

These stark circumstances have slowly been giving rise to widespread environmental concern among Chinese people and a growing environmental movement. According to national statistics, the number of environment-related complaints filed by Chinese citizens to environmental authorities has increased over 30% since 2002, with roughly 50,000 environmental disputes taking place in

2005 alone. These statistics conform with a trend towards more popular environmental protests over the past decade (Zhang, 2009).

When sociologists began to study Chinese people's environmental attitudes, their extensive survey work revealed moderate to serious concern (Harris, 2006; Hong, 2005; SEPA, 1999). These findings correspond to a pattern that has been studied in Western countries of citizens expressing increasing environmental concern as economic growth accelerates and pollution worsens. However, early Chinese studies seldom employed rigorous methodologies in evaluating environmental attitudes.¹ The large-scale Chinese General Social Survey (CGSS) of 2003 begins to address this research gap; its environmental module includes questions that can be used to construct multiple measures of environmental worldviews, attitudes, and willingness to pay for environmental protection (Xiao & McCright, 2007). With the CGSS's more comprehensive data, scholars discovered that the Chinese populace not only expresses pro-environmental attitudes, but their

* Tel.: +86 10 82338727.

E-mail address: xueying@umich.edu.

¹ Instead, the conclusions of early environmental attitude studies in China were drawn based on either very general questions about environmental protection or very specific ones about certain environmental problems. Abstract and methodology sections of 251 Chinese studies were examined and only 19 of them used a widely recognized scale to evaluate environmental attitudes.

attitudes are also supported by a coherent environmental belief system (Xiao, Dunlap, & Hong, 2013).

While the 2003 CGSS gave a sense of Chinese people's environmental attitudes, its scope was limited to urban samples, leaving out the attitudes of the rural Chinese.² To better understand overall environmental attitudes, as well as to predict the future trend of environmental movements in China, a rigorous evaluation of environmental awareness in rural contexts is imperative. Inclusion of China's rural populations – which numbers nearly 700 million – is also an environmental justice concern. In recent years, as urban regions have implemented stricter environmental regulations, polluting firms have moved to rural areas where regulations remain weak. As a result, rural China is shouldering disproportionately heavy environmental burdens (Hao, 2005; Pan et al., 2001; Wang & Jin, 2008; Zhang, 2009).

Using a combined rural–urban sample collected from 12 counties in four culturally and biophysically diverse provinces – Heilongjiang, Ningxia, Chongqing, and Yunnan – this study provides a comprehensive evaluation of rural Chinese residents' environmental attitudes. It also qualitatively and quantitatively compares rural residents' attitudes with those of urban people. The results indicate that (1) rural residents are generally less concerned about the environment and accordingly score lower on the New Ecological Paradigm (NEP) scale than urban residents; (2) actual environmental suffering plays a key role in shaping people's concern about the environment³; and (3) education is a key factor behind the rural–urban difference in environmental attitudes. When asked to identify some environmental issues that China faces, 12.3% of rural respondents were unable to come up with an answer, a phenomenon not observed among urban samples. The quantitative analysis reveals an education gap that may explain this urban–rural difference in terms of articulating environmental problems.

Rural populations' less pro-environment attitudes, as well as their tendency to focus on agricultural issues while ignoring what they may view as distant and latent 'city problems' may partially explain the fact that the relocation of polluting firms in rural China rarely meets opposition. Following the 'path of least resistance' to less populated agrarian communities that often have laxer environmental regulations (or unenforced ones), industry is increasingly wrecking havoc on China's rural environment. To break this vicious cycle, education or training tailored to rural communities is essential to equipping rural people with more knowledge about the harmful consequences of environmental degradation.

In what follows, Section 2 of this paper reviews theoretical approaches to measuring and predicting people's environmental attitudes. The research question is raised immediately following the review. The question is then answered based on a set of survey data that is described in Section 3 and analyzed in Section 4. Section 5 concludes the paper.

2. Theoretical perspective and research question

In the 1960s, sociologists and environmentally minded scholars began to study environmental attitudes. This scholarship flourished in the 1970s as environmental degradation worsened and became a greater concern to the general public in Western societies (Heberlein, 1981). Over the past several decades, scholars' theoretical and empirical efforts have been devoted to designing proper

measures to gauge pro-environmental attitudes in Western industrialized social contexts (Milfont & Duckitt, 2010; Stets & Biga, 2003; Tognacci, Weigel, Wieden, & Vernon, 1972; Weigel & Weigel, 1978). The NEP scale, first introduced by Dunlap and Van Liere in 1978 as the New Environmental Paradigm and then revised by Dunlap, Van Liere, Merting, and Jones, in 2000, is the most widely accepted measure. While the 12 items in the old scale reflect three aspects of environmental attitudes – "the existence of limits to growth for human societies," "the balance of nature," and "humanity's right to rule over the rest of nature" – the revised scale extends the analysis by adding three new items that consider ecological worldviews (Dunlap et al., 2000).⁴

As these Western-focused studies suggest, at the individual level, environmental attitudes are shaped by a person's demographic background, including age, gender, and education. Young people are more likely to hold pro-environmental attitudes because: (1) they are not as integrated into the dominant social order, which often views environmental protection as threatening existing institutions; (2) they have better access to environmental information; and (3) they cherish the long-term benefits of environmental protection more than older people who may not live long enough to enjoy them (Carlsson & Johansson-Stenman, 2000; Malkis & Grasmick, 1977; Mohai & Twilight, 1987; Shen & Saito, 2008; Van Liere & Dunlap, 1980; Whitehead & Blomquist, 1991). Studies in Western countries have found that women are usually more concerned about the environment than men because of traditional female socialization experiences, cultural norms, and women's traditional roles as caregivers, nurturers, mothers, and protectors of children (Hunter, Hatch, & Johnson, 2004; Karpiak & Baril, 2008; Merchant, 1990; Mohai, 1992; Scott & Willits, 1994). Past research has also demonstrated that more educated people are more likely to show concern for the environment, since they are often better able to think critically and to recognize negative environmental consequences, especially those harms that are less obviously decipherable, such as climate change or toxins in foods (Dalton, 1984; Dietz, Stern, & Guagnano, 1998; Stevens, 1984).

Scholars of environmental attitudes have also studied income as a correlate of environmental concern, however, its impact has been debated. Theoretically, people with greater financial resources should be more concerned about the environment because they are relatively free of economic pressures and tend to demand a cleaner environment, which can be considered a form of a luxury good under Maslow's "Hierarchy of Needs" Framework (1954). In contrast, as Van Liere and Dunlap (1980) argue, people facing the urgency of satisfying basic survival needs (such as housing, food, safety, and employment) may tolerate more environmental degradation. Other scholars have suggested that the poor may even embrace polluting entities if industry brings new employment opportunities to their communities (Gelober, 1992). However, the idea of environmental concern as a luxury good has been repeatedly challenged by empirical studies, with research showing that income does not have a consistent impact on environmental concern. In fact, survey-based research spanning from the 1980s to the present has consistently found that people in low-income communities are at least as concerned about the environment as are residents in communities with higher than average incomes (Adeola, 1994; Antil, 1984; Hirsh, 2010).

This contradiction manifests another key determinant of people's environmental concern: actual levels of environmental suffering. As early as 1967, DeGroot found a significant "rank-order correlation between the frequency with which respondents

² Of the 19 studies with rigorous evaluations of environmental attitudes, only two of them involve data from rural samples (Li, 2011; Wang & Fu, 2011).

³ While urban residents pay more attention to issues associated with their city lives – issues such as noise, excessive waste, and water and air pollution – rural residents are more likely to be focused on desertification, land erosion, soil decay, water shortages, and other issues that directly affect agricultural production.

⁴ For a complete list of the items, please refer to Dunlap and Van Liere (1978) and Dunlap et al. (2000).

perceived neighborhood air pollution as a problem, and the actually measured level of suspended particulars in that neighborhood.” Since low-income communities are more vulnerable to environmental hazards, DeGroot’s correlation would suggest more serious environmental concern among them. Environmental justice scholars, in particular, have focused on this correlation, extending their analyses to environmental inequalities between Black and White communities (Mohai & Bryant, 1998; Robin & Mohai, 2005; Tremblay & Dunlap, 1978). Their results indicate a strong correlation on the individual level between environmental suffering and environmental concern. These findings support Inglehart’s (1995) “objective problem” hypothesis, which emerged from World Value Survey data from 43 countries and on a national level showed that support for environmental protection was most pronounced in countries where there was either a high per capita income or an abundance of environmental problems.

Somewhat unexpectedly, most of these theories about environmental attitudes derived from Western societies have also held up when applied to China’s social landscape. The few studies of Chinese people’s environmental attitudes in the past 20 years have confirmed that pro-environmental attitudes are more likely to be found among young people, women, the educated, and those most personally affected by environmental degradation (Chung & Poon, 1999; Shen & Saito, 2008; Tang, Zhou, & Kuang, 2009; Wu, 1997). This consistency across hemispheres suggests that causes for individuals’ environmental concern may be universal rather than culture-specific. It may, therefore, be possible to argue that in any given society, a person who is in a caregiver role, has access to environmental knowledge, and suffers from living in a polluted or degraded environment is likely to be concerned about the environment. Milfont’s (2012) overview of studies of how culture influences environmental attitudes reveals that cultural factors are significant only at the national level – at the individual level, findings about how gender, income, and other factors influence environmental attitudes often hold up across cultures.

Nonetheless, this social structural analysis may lead to controversial conjectures with regard to this paper’s research question: *Do rural and urban Chinese people hold similar attitudes and concerns about the environment?* On the one hand, it is generally recognized that rural populations in China are poorer and less educated than urban populations. Per capita income is RMB 3587 (USD 473⁵) in rural areas and RMB 11,759 (USD 1551) in urban areas (China Rural Statistical Yearbook, 2007); rural individuals on average get 7 years of education, compared to urban individuals’ average of 9.4 years (Chinese National Census Data, 2004). Based on scholarship that connects income and education to environmental attitudes, it may be safe to assume that rural Chinese people are less concerned about the environment than city-dwellers. On the other hand, though, people living in rural China suffer from a rapidly deteriorating environment. Unlike the western countries where pollution concentrates in urban areas, in China, small polluting firms are becoming prevalent in rural areas (Huang, 2008). Rural Chinese residents commonly lack clean cooking energy, purified drinking water, modern sanitation systems, and waste treatment facilities (Hao, 2005; Pan et al., 2001; Wang & Jin, 2008). Based on the “object problem” hypothesis, they might actually be *more* concerned about the environment than their urban counterparts.

Until now, empirical studies have not been able to understand the effects of rural or urban living on environmental attitudes in China. While Hong (2005) finds that people living in larger cities are more concerned about the environment (mainly because they are more exposed to news about environmental harm), others

(Chung & Poon, 2001; Zhang, Liu, Wu, Li, & Wu, 2001) demonstrate that rural populations score higher on some environmental attitude scales. Some researchers even argue that rural and urban residents’ environmental attitudes are actually incomparable because these two groups are concerned about very different issues (Harris, 2006; Tang et al., 2009). This paper aims to bridge this gap by providing an in-depth analysis of rural–urban differences in environmental attitudes in China.

3. Method

3.1. Sampling and sample characteristics

China is a nation of diverse cultures and biophysical environments. In order to account for this diversity and its potential effects on environmental attitudes, this study surveyed four culturally and biophysically diverse provinces: Ningxia, Chongqing, Yunnan, and Heilongjiang (Fig. 1) from May to August of 2011.

Ningxia is located in the northwestern arid region and has been described as one of the world’s most unsuitable areas for human habitation (UNDP, 2010). Through living with extreme scarcity, residents of Ningxia have become accustomed to conserving resources. The midwestern province of Chongqing has hilly topography that also makes agriculture difficult (Xu, 2001), even though the warm and humid climate of the region is good for plant growth (Zhang, 1987). Residents of Chongqing emphasize individual control of the land and its resources. Yunnan has yet a different constitution; this southern province is home to many ethnic minorities whose environmental perceptions are influenced by religious beliefs and traditional practices of collective ownership (Guo, 2001). Finally, the northeastern province of Heilongjiang is characterized by fluvial plains and rich stocks of natural resources (Li & Xie, 2006; Zhang, 1987), an abundance that has contributed to residents’ generosity in using and sharing resources.

In addition to these general differences in biophysical characteristics, there are East–West and North–South differences in the social cultures of China. During the Dynasty of Han and Tang, two cultural groups were formed to the west and east of Tong Guan, a crucial geographical county next to Chang’an, the capital at the time. In Guanxi (west of Tong Guan), hunting is the main culture, whereas in Guandong (east to Tong Guan), agriculture dominates the landscape and cultural practices. These sharp East–West differences were minimized after the late Tang Dynasty when East–West communications were strengthened, and today the differences are almost entirely muted (Hu, 2002).

Nonetheless, North–South⁶ differences remain significant. Lin (1938) describes northern Chinese people as “simple thinking and hard living, hearty and humorous, children of nature, more Mongolic and more conservative” (pp. 17). On the other hand, he writes that the southern Chinese are “mentally developed but physically retrograde, loving their poetry and their comforts, and shrewd in business” (pp. 17). Similar descriptions of the North–South dichotomy appear in the works of Huntington and Pan (1933). Although these descriptions are somewhat caricaturesque, the “hard living people” and “comfort lovers” may hold distinct attitudes towards the natural environment. In order to account for the general North–South differences, this study examines two sample provinces from the North (Ningxia and Heilongjiang) and two from the South (Chongqing and Yunnan).

In order to make this study as representative of the Chinese population as possible, three diverse counties in each province were selected

⁵ USD values are calculated with the average RMB-USD exchange rate in 2007.

⁶ The geographical dividing line between northern and southern China is the Huai River-Qin Mountains line.

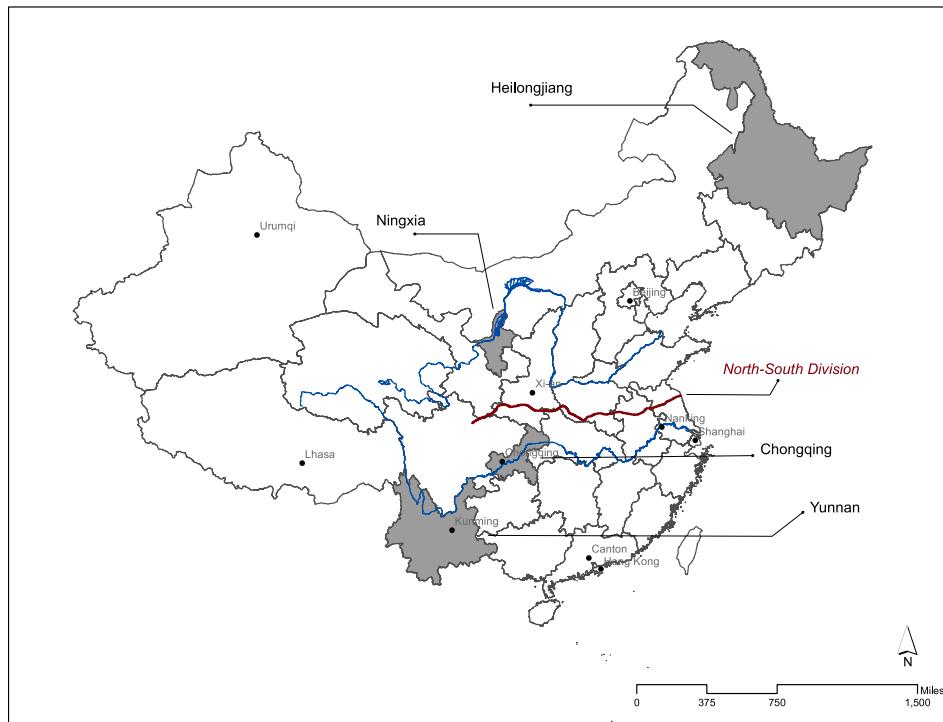


Fig. 1. Map of China showing the four provinces studied. The North–South division is mapped out based on a GIS simulation of the North–South demarcation zone in China (Zhang et al., 2012).

for surveying. In Ningxia and Chongqing, two sample counties were selected from the pool with per capita incomes above the provincial average, and one with per capita income lower than provincial average. In Heilongjiang and Yunnan, the inverse was selected: one county with higher than average incomes and two counties with lower than average incomes. Within each county, one rural and one urban community were randomly selected.

Twenty-four respondents were recruited in each community using a combination of snowball and stratified sampling techniques. In order to mitigate the potential biases of snowball sampling (i.e. closely-related interviewees tend to hold similar views), interviews in each community began with a senior resident whose local connections were extensive enough to cover a wide range of candidates for further interviews. Furthermore, the samples were separated into four strata based on income and education levels: one high income and high education group; one high income and low education group; one low income and high education group; and one low income and low education group. These stratified samples at least reflect a general variation in environmental attitudes based on income and education levels. Over the course of the four-month study, 576 participants were approached for interviews, with 347 ultimately completing the interview, for a response rate of 60 percent.

Respondents' demographic information is summarized in Table 1. Of the 347 respondents, 324 reported their age and 329 indicated their educational level (the number of years they were in school). Respondents were asked to indicate their annual household income, which was used as an indicator of individual income level.⁷ I recorded the respondent's gender was recorded by the

interviewer. Response rate was fairly even between genders: 182 men and 165 women participated in the study. The respondent's address was used to determine urban or rural residency.

3.2. Interviews, environmental scales, and indices

Respondents' environmental attitudes were evaluated both qualitatively and quantitatively. First, interviewees were prompted to list the top three environmental issues facing the country, responding to the open-ended question of "What do you think are

Table 1
Sample distribution.

Variable	Category	Total number of respondents	Percentage	Number of rural respondents	Number of urban respondents
Gender	Male	182	52.4	122	60
	Female	165	47.6	81	84
Age (years)	15–24	124	35.7	35	89
	25–33	38	11.0	33	5
	34–48	110	31.7	71	39
	49–74	52	15.0	44	8
	Unknown	23	6.6	20	3
Educational	Less than High School	133	38.3	112	21
	High School	63	18.2	39	24
	College	133	38.3	44	89
	Unknown	18	5.2	12	6
Income (RMB)	0–9999	203	58.5	88	115
	10,000–30,000	107	30.8	88	19
	Above 30,000	37	10.7	27	10
Region	Chongqing	97	28.0	54	43
	Heilongjiang	85	24.5	46	39
	Ningxia	93	26.8	62	31
	Yunnan	72	20.7	44	28
Residency	Rural	203	58.5		
	Urban	144	41.5		

⁷ In China, income is usually shared among family members. Thus, household income may be a better indicator of income level than individual income. Some interviewees are reluctant to reveal the exact income of their households. In this case, they were encouraged to indicate an income range. The average of the upper and lower boundaries of the range is used to estimate these interviewees' annual household incomes.

the three most urgent environmental problems in China?" This question came at the beginning of each interview in order to avoid any potential bias that might arise from subsequent questions. After that, subjects' environmental attitudes were quantitatively evaluated using the modified NEP scale devised by Hong (2006).⁸ This scale⁹ includes 13 statements used to better gauge Chinese people's environmental attitudes; respondents were asked to indicate the extent to which they agree or disagree with these statements. Eight of the statements were worded in such a way that agreement with the statement reflected acceptance of the NEP, and for the other five, disagreement reflected acceptance. Answers were coded on a Likert scale: 5 = "strongly agree", 4 = "agree", 3 = "neutral", 2 = "disagree somewhat", and 1 = "strongly disagree" for the eight pro-NEP items, and the inverse for the five anti-NEP ones. An NEP score between one and five was assigned for each interviewee by averaging scores across all 13 items. With a Cronbach's alpha of 0.759, Hong's revised NEP can be considered an internally consistent measure of environmental attitudes in the sample.

Corresponding to the two main sections of the survey, the following section analyzes respondents' environmental attitudes in two ways: First, rural and urban populations' concern over specific environmental problems are compared to explore how their environmental concerns qualitatively differ from each other. Second, respondents' environmental attitudes are quantitatively evaluated using the revised NEP scale, and these attitudes are then related to demographic characteristics. In this way, the study parses out the key factor(s) that influence Chinese people's environmental attitudes.

4. Results and discussion

This section reports and discusses the results of the qualitative and quantitative evaluation of rural and urban people's environmental attitudes in sequence. The qualitative analysis illustrates the different patterns between rural and urban people's attitudes towards environmental issues, and suggests more serious concern about the environment among urban people. This result is confirmed with the quantitative analysis, which shows that urban people generally scored higher than their rural counterparts on the revised NEP scale. The quantitative score is then related to the demographic variables, and this step of the analysis reveals that education is the key factor that leads to the rural–urban differences in environmental attitudes in China.

4.1. Qualitative evaluation

Table 2 summarizes the responses to the open-ended question of the qualitative analysis, with the "urgent environmental issues" that

⁸ Since the NEP scale was originally developed in the US, it may not properly fit into the Chinese context with its different social and cultural norms. With national social survey data, Hong analyzed the NEP's adoptability in China. While the original NEP scale (the New Ecological Paradigm) was reasonably reliable and valid when applied to Chinese samples, Hong suggested some minor revisions to improve its adoptability.

⁹ In the reduced version, two items were excluded: (1) "human ingenuity will ensure that we do not make the earth uninhabitable" and (2) "humans will eventually learn enough about how nature works to be able to control it." These exclusions were made because (1) discrimination indexes of the two items were low and they could not effectively distinguish high and low environmental concern among Chinese samples, and (2) when the two items were dropped off, the Cronbach's alpha of the NEP scale reached its peak value and any further reduction would decrease the Cronbach's alpha. Although the reduction suggested by Hong led to imbalanced distribution of items on the five dimensions of the NEP, the reduced version would still be a fair measure as it did no harm on the scale's reliability and still covered all the dimensions in the original NEP scale.

Table 2
Environmental problems concerning rural and urban people.

Environmental problems	Rural	Urban	Difference	Significance ^a
General environmental issues	16.7%	12.5%	4.2%	
Pollution	75.4%	96.5%	-21.2%	**
General pollution	27.6%	29.9%	-2.3%	
Air pollution	51.2%	75.7%	-24.5%	**
Water pollution	39.4%	64.6%	-25.2%	**
Industrial pollution	4.4%	12.5%	-8.1%	**
Other	13.8%	18.1%	-4.3%	
Natural preservation	36.5%	62.5%	-26.0%	**
Green vegetation	8.4%	13.9%	-5.5%	
Desertification	3.0%	2.1%	0.9%	
Water conservation	8.4%	23.6%	-15.2%	**
Land erosion	4.4%	2.8%	1.7%	
Other	22.7%	47.2%	-24.6%	**
Resource conservation	42.9%	46.5%	-3.7%	
General resource issues	16.7%	18.8%	-2.0%	
Water shortages	22.2%	23.6%	-1.4%	
Energy shortages	12.3%	5.6%	6.8%	*
Forests	5.4%	8.3%	-2.9%	
Global environment	18.7%	51.4%	-32.7%	**
Ozone depletion	15.8%	39.6%	-23.8%	**
Global warming	5.9%	26.4%	-20.5%	**
Community environment	44.3%	54.2%	-9.8%	
Domestic waste	30.5%	43.1%	-12.5%	*
Human waste	7.9%	2.8%	5.1%	
Noise	7.9%	21.5%	-13.6%	**
Other	5.4%	2.1%	3.3%	
Environmental awareness	3.0%	3.5%	-0.5%	
Don't know	12.3%	0.0%	12.3%	**
Other environmental problems	25.1%	27.8%	-2.7%	
Population	12.3%	12.5%	-0.2%	
Food security	6.4%	11.1%	-4.7%	
Other	10.8%	11.1%	-0.3%	

Note: This table summarizes rural and urban respondents' mentions of specific and general environmental problems as the most urgent issues facing China. All of the issues were summarized directly from interviewees' responses. For example, "environmental awareness" refers to a concern that people are lacking the awareness needed to protect the environment. The "don't know" category tracks the interviewees who could not identify an environmental problem in China. The percentage for a subcategory (e.g., air, water, etc.) represents the proportion of respondents who mentioned some issues related to that subcategory. The percentage for a category (e.g., pollution, natural preservation, etc.) accounts for the number of people who mentioned at least one issue in that category. The sum of the aggregate percentages may be larger than 100 since many respondents mentioned issues in more than one category. Statistical significance based on t-test: ** $p \leq 0.01$, * $p \leq 0.05$.

^a The sample used in this study is a non-probability one. Statistical significance is used here to aid in the interpretation of results, but may lead to some bias in terms of the population's characteristics. This note applies to all following statistical analyses with significance tests.

respondents brought up grouped into nine major categories. Generally, urban residents expressed a higher level of concern about almost all issues. Pollution was the top issue concerning both rural and urban populations, but more urban than rural residents mentioned it: While three out of four rural interviewees cited pollution as an urgent environmental concern, 96.5% of urban residents brought up at least one type of pollution as an issue. Respondents seemed to be particularly concerned with air and water pollution. Among urban residents, three out of four interviewees specifically mentioned air degradation as an urgent environmental concern, while almost half mentioned poor water quality. Concern for each of these specific pollution issues was slightly lower among rural residents: about half of rural interviewees mentioned air quality and two out of five brought up water pollution. Rural–urban differences are statistically significant for both issues. Overall, rural residents tended to either raise pollution as a very general problem, or complain about issues directly related to agricultural production, such as decreases in soil fertility. They seldom, however, connected problems with soil fertility to erosion, water pollution, or other root causes of environmental degradation.

Natural preservation is another category that distinguished rural and urban people's environmental concerns. Overall, urban respondents were nearly twice as likely to mention issues under the category of natural preservation as were rural respondents (62.5% compared to 36.5%). This overall categorical difference stems from the fact that urban groups were significantly more likely than rural ones to raise concerns about two particular issues under this category: water conservation and "other" conservation issues. While only 8.4% of rural respondents mentioned water conservation as a key issue challenging China, almost a quarter of urban interviewees brought up dwindling water resources as a concern. Urban residents were also more likely to be concerned about species extinction, extreme weather, and natural disasters, all of which barely came up in the open-ended question conversation with rural residents. The only major issues under the category of natural preservation that many rural residents named as a concern were again related to agricultural production – namely desertification and land erosion.

Rural–urban difference was even more salient with respect to global environmental issues. While over half of urban residents expressed some concern about global environmental issues, less than one fifth of rural residents did so. In particular, over a third of urban residents raised the issue of ozone layer depletion, and a quarter were concerned about global warming. In contrast, only about one out of six rural residents brought up ozone layer depletion, while less than one in twenty mentioned global warming.

For the other two categories, resource conservation and community environment, rural–urban difference is only significant for particular subcategories. For example, significantly more rural respondents were concerned with energy shortage than urban respondents, but more urban residents than rural ones were concerned with waste disposal and noise. Furthermore, urban residents were more likely than their rural counterparts to mention "Other" environmental issues. For example, urbanites often touched on the topics of food security, drug security, nuclear pollution, and natural disasters, all of which appeared in news headlines during the survey period.¹⁰

This analysis demonstrates distinct patterns in rural and urban Chinese residents' environmental concerns. The qualitative study confirmed Inglehart's "objective problem" hypothesis: actual environmental suffering does seem to shape people's environmental attitudes to some extent. Both rural and urban residents paid more attention to issues that affected their daily lives. Since most rural residents are engaged in agricultural production, their responses more frequently raised complaints about desertification, loss of land, soil decay, and water shortages. On the other hand, urbanites in heavily populated cities were more likely to be concerned with typical "city maladies," such as noise, excessive waste, and water and air pollution.

The open-ended question results also supported the idea that, on the whole, urban residents are more knowledgeable than their rural counterparts when it comes to understanding environmental issues, especially the more remote and abstract global issues. When asked to cite some urgent issues facing China, none of the urban respondents indicated that they did not know any, but 12.3% of rural residents came up blank. Such knowledge divergence may reflect a gap in environmental education between rural and urban communities. Scholars agree that

environmental education in China is achieved in three primary ways: (1) formal curriculum classes and extra-curricular activities that are developed in the school system, (2) special workshops that are aimed at environmental professionals and local leaders, and (3) information dissemination through mass media (Kwan & Lidstone, 1998; Lee & Tilbury, 1998). Among the three approaches, the second one is rarely employed in rural areas, and the other two are far less developed in rural regions than they are in urban centers. Environmental courses such as geography, biology, ecology, and environmental studies are missing from the curricula of most rural primary and middle schools, and few rural residents receive formal education beyond these levels. In addition, media coverage of environmental issues is relatively limited in rural China. These trends likely contribute to the knowledge gap between rural and urban people, but more research is needed to investigate the causal relationships between institutional forms of environmental awareness and environmental attitudes.

Another theme that stood out from the results of the open-ended question about environmental concern was that, in both urban and rural communities, people's environmental attitudes and concerns are dynamic and significantly influenced by current shocking events and the media's coverage of them. For instance, over 10% of respondents related China's environmental challenges with hot topics in the news during the survey period – issues such as food security, nuclear pollution, and natural disasters. In contrast, fewer than 10% of respondents mentioned longer-term and arguably more pervasive environmental problems such as forest degradation and energy shortages – these issues are rarely 'breaking news.' The fact that relatively high percentages of respondents mentioned environmental issues that were in the news during the study period supports the idea that media outlets strongly influence public opinion on the environment (Hansen, 1991; Parlour & Schatzow, 1978).

4.2. Quantitative evaluation

In addition to interviews, this study quantitatively evaluated people's environmental attitudes with a revised NEP scale as discussed above. In order to determine the effect of residency (urban or rural) on environmental attitudes, the NEP scale was related to residency in a multivariate regression model with all other demographic variables, including, age, gender, income, education, and region, controlled.

Basic correlative analysis confirmed some traditional views about the social basis of environmental attitudes. Younger female respondents with higher education levels were more likely to hold pro-environmental attitudes, as they scored higher on the NEP (Table 3). In addition, the preliminary correlative analysis reflected the general trend that urban populations who attained higher levels of education were more concerned with the environment.

Given the strong correlation among residency, education, and the NEP, further multivariate analysis is necessary to determine the impact of residency and education on environmental attitudes. Two nested multiple regression models were run, one with residency and one without, to test its predictive capacity on the NEP. If residency were only reflective of the educational effects, total variance explained by Model II would not significantly decrease compared to Model I (Table 4). However, this hypothesis is rejected by an ANOVA test that compares the two models. Thus, it could be concluded that residency's influence on environmental attitudes were independent of other demographic factors. When residency was excluded from the regression, education became the only significant predictor. It may be inferred

¹⁰ During my interview period, news about the scandal of contaminated baby formula was pervasive in China, and almost evolved into a national crisis. Meanwhile, Japan's nuclear disaster arose in the aftermath of the earthquake and tsunami.

Table 3

Correlations between the NEP scale and social structural variables.

	NEP	Income	Education	Age	Gender	Region	Residency
NEP	1.00						
Income	-0.08	1.00					
Education	0.25**	-0.08	1.00				
Age	-0.14**	0.29**	-0.40**	1.00			
Gender	0.13*	-0.12	0.11	-0.12	1.00		
Region	0.03	0.14*	-0.10	0.10	-0.09	1.00	
Residency	0.28**	0.00	0.42**	-0.34**	0.16**	0.01	1.00

Note: This table summarizes the correlation coefficients between demographic variables (i.e. income, education, age, gender, region, and residency) and the NEP scale. For the correlations between continuous variables (i.e. NEP, Income, Education, and Age), Pearson coefficients were reported. The other three demographic variables – gender, region, and residency – were categorical and were coded as follows: males were coded as 0 and females were coded as 1; Northern provinces (Heilongjiang and Ningxia) were coded as 1 and Southern provinces (Chongqing and Yunnan) were coded as 0; and rural residency was coded as 0 and urban residency was coded as 1. For the correlations between continuous variables and the categorical variables, Pearson coefficients were reported. Statistical significance based on *t*-test: ***p* ≤ 0.01, **p* ≤ 0.05.

from this switch that residential location may partially overlap with education level in determining rural and urban populations' environmental attitudes. The low indices of *R*-squared and adjusted *R*-squared for both models indicate potential influences from hidden factors, such as degree of actual environmental suffering.

Interaction effects between residency and each demographic variable on the NEP score were further examined to explore the ways in which residency affected environmental attitudes. In the two-way ANOVA analysis, continuous demographic variables were first transformed to ordinal ones,¹¹ then the means of NEP scores were compared among the sub-groups.

As expected, for both urban and rural samples, income and gender had no significant effects on the NEP score (Figs. 2 and 3). However, the pattern of residential difference varied a lot among the age groups (Fig. 4). While the average NEP score did not significantly differ for the 15–24 age group among rural and urban samples, it significantly diverged for older groups, especially the cohort of 49- to 74-year-olds. This cohort was born around the founding of the People's Republic of China and experienced extreme economic hardships during 1960–1962. Given the culture of scrappiness and resource use this age group grew up with, it is, more likely that they would consider the environment to be something to be exploited rather than protected.¹² Yet, over years of living in urban societies, some members of this age cohort may have had the opportunity to change their views as they were exposed to more environmental information. Those remaining in rural communities may not have had the same opportunities to expand their environmental knowledge and thus possibly change

¹¹ The respondents are divided into four age groups: 15–24 years old, 25–33 years old, 34–48 years old, and 49–74 years old. These age cohorts correspond to time periods with significant historical events that may influence environmental attitudes in China. In 1949, the People's Republic of China (PRC) was founded, which transformed China from a wartime capitalist society to a peacetime socialist one. The economic hardship at the early stage of the PRC crested during the great famine in 1960–1962 which caused over 36 million deaths (Yang, 2008). Many studies indicate that people born around this period were more frugal in resource use. The economic reform in 1978 radically transformed China from a planned economy to one with a market orientation, initiating China's economic boom. Along with the economic reform, an open-up policy was fully implemented around 1987. This policy helped break the ideological wall around China and expose Chinese people to Western cultures and ideologies. Educational level was measured by the number of years respondents attended school: less than high school (0–9 years), high school (10–12 years), and college (more than 12 years). The annual household incomes are divided into three categories: RMB 0–9999 (USD 0–1548), RMB 10,000–30,000 (USD 1548–4645), and greater than RMB 30,000 (USD 4645). The RMB 10,000 (USD 1548) and RMB 30,000 (USD 4645) correspond roughly to China's poverty threshold and average income, respectively.

¹² Please refer to the discussion of the Exploitative Capitalist Paradigm in Taylor (2000).

Table 4
OLS regression analysis of the NEP score.

Predictor	Model I			Model II		
	β	<i>t</i>	<i>p</i>	β	<i>t</i>	<i>p</i>
Income	0.00	1.11	0.27	0.00	1.13	0.26
Education	0.02	2.38	0.02**	0.02	2.78	0.01**
Age	0.00	0.06	0.95	-0.00	-0.84	0.40
Gender_Female	0.06	1.29	0.20	0.07	1.28	0.20
Region_North	0.02	0.41	0.68	0.04	0.69	0.49
Residency_Urban	0.18	2.26	0.03**			
Model summary	<i>R</i> -squared: 0.10			<i>R</i> -squared: 0.08		
	Adjusted <i>R</i> -squared: 0.07			Adjusted <i>R</i> -squared: 0.06		
	F-value: 4.279, <i>p</i> -value: 0.00			F-value: 4.044, <i>p</i> -value: 0.00		
	Shapiro–Wilk Normality Test: <i>W</i> : 0.98, <i>p</i> -value: 0.00			Shapiro–Wilk Normality Test: <i>W</i> : 0.98, <i>p</i> -value: 0.00		
	Model comparison <i>F</i> -value: 5.11, <i>p</i> -value: 0.02					

Note: Results of two linear regressions of NEP on its potential predictors. Income, education, and age are continuous variables. Gender, region, and residency are categorical variables, with the coding methods specified above. Linear model assumptions are checked by plotting residuals against expected NEP scores. It is shown that residues of both models have equal and unbiased variance. The Q–Q plots also show that the residuals are approximately normally distributed, although this is not supported by the Shapiro–Wilk tests. However, since the sample size is large (*N* > 200), the Shapiro–Wilk test would not be a hurdle to disprove the robustness of *t*-tests. The two models are compared based on the ANOVA test. ***p* ≤ 0.01, **p* ≤ 0.05.

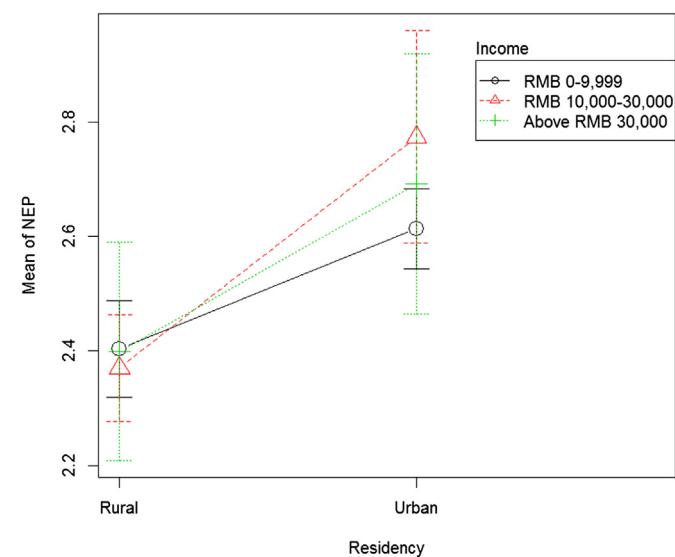


Fig. 2. Residential difference in NEP among income groups.

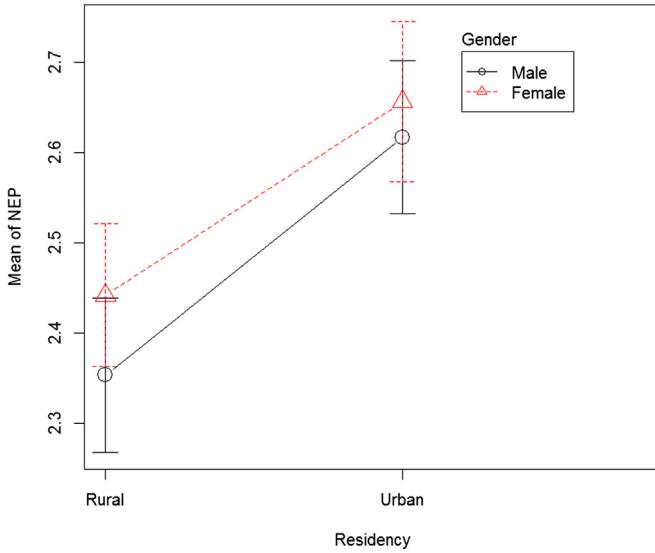


Fig. 3. Residential difference in NEP among gender groups.

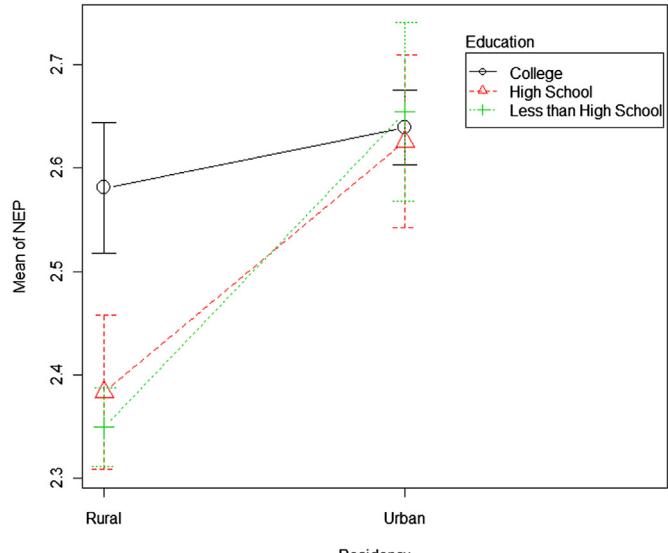


Fig. 5. Residential difference in NEP among education groups.

their attitudes. Hence, people born around the 1960s that continue to live in rural areas might hold onto anti-NEP attitudes.

Residency also interacts with education to influence the NEP (Fig. 5). While residential difference was negligible for the group with an educational attainment above the college level, it was significant for the other two educational groups. In the urban sample, all educational groups obtained similar NEP scores, however, the groups with fewer years of education in the rural sample scored much lower. It may be inferred from the distinct patterns of education effects that a pro-NEP attitude is most likely to be found among either urban-dwellers or highly educated people. In other words, urban living experiences and higher educational attainment are equally important determinants of pro-environmental attitudes.

Finally, the residential effect on environmental attitudes differed across regions, as shown in Fig. 6. While the average NEP

scores for rural samples were quite similar across all four provinces, they differed significantly among urban samples. For example, the average NEP score in the urban Ningxia sample was relatively low while that of Heilongjiang was comparatively high. This resulted in a small rural–urban gap in NEP in Ningxia and a large one in Heilongjiang. Regional variation of rural–urban differences in environmental attitudes may be related to the varying degrees of industrialization and resource scarcity in different parts of China. As early as the 1950s, Heilongjiang was positioned as a base for industrial development, and it is still ranked as one of the top ten industrialized provinces in China (Zhang, 1992; Zhang & Wu, 2006). One possible explanation for the pro-environment attitudes expressed by city-dwellers of Heilongjiang might therefore be that the province's long-term involvement in industrial production exemplified to urban residents the limits to growth as they

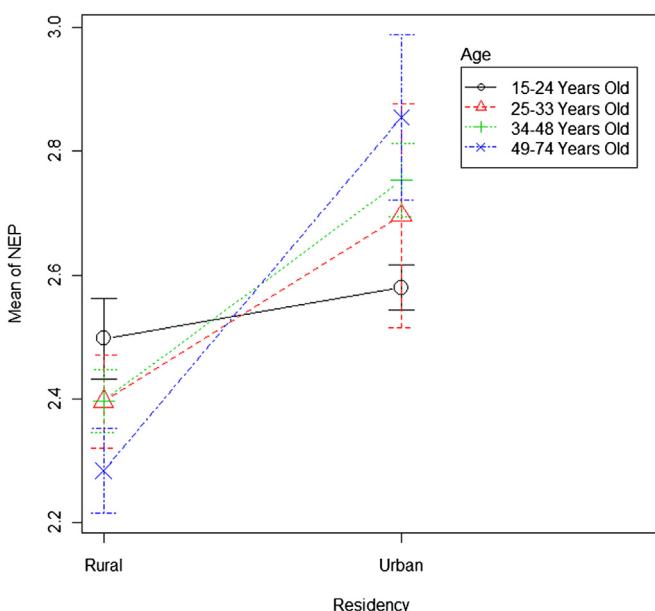


Fig. 4. Residential difference in NEP among age groups.

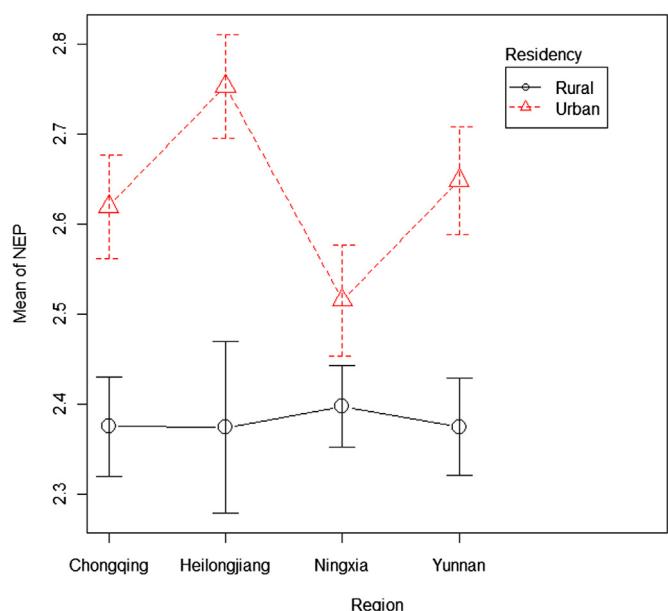


Fig. 6. Regional difference in NEP among residency groups.

experienced the many externalities of air pollution, dirty water, and resource exhaustion. Residents that grew up in the shadow of pollution may accordingly score higher on the NEP scale. In contrast, Ningxia is one of the least industrialized provinces, its economy dominated by agricultural production (Zhang & Wu, 2006). Even urban culture in Ningxia is influenced by agricultural practices, which highlights the natural environment's role as an essential supplier of resources. This may explain why rural and urban residents in Ningxia scored similarly on NEP – the rural–urban difference is not as prominent in this province as in the others in this study.

Resource scarcity is another factor that may distinguish Heilongjiang and Ningxia. Heilongjiang is located in the Sanjiang Plain, which is characterized by abundant stock of water, forests, and mineral resources and moderate levels of agricultural production. Rich resource endowment often mitigates tensions between environmental preservation and human demands, and urban residents in Heilongjiang. Perhaps because they are not forced to choose between meeting their own needs and protecting natural resources, residents of Heilongjiang are more likely to have pro-environment attitudes (Li & Xie, 2006). In contrast, resource scarcity and land infertility in Ningxia put nature preservation directly at odds with human needs (Jiang & Zhang, 2005). Under these circumstances, people have a tendency to downplay environmental destruction, even viewing it as an inevitable by-product of industrial advancement. Taylor (2000) calls this view of development as incompatible with the goals of preservation and sustainability the *exploitative capitalist paradigm*, and the theory may partly explain the relatively low NEP scores in Ningxia.

5. Conclusion

Overall, this study supports the claim that urban residents are more concerned about the environment than rural residents in China. City-dwellers expressed higher concern about almost all of the environmental problems mentioned in the open-ended questions, and were also more readily able to articulate environmental issues. The gap between rural and urban residents' environmental concern was particularly wide when the issues of pollution, natural preservation, and global environment were considered. Particularly, rural residents' attention was mostly drawn to issues closely related to agricultural production, such as desertification, land erosion, soil decay, and water shortages. In addition, rural interviewees were more likely than urban interviewees to respond to open-ended questions by providing very general answers or simply saying "I have no idea." The tendency of rural residents to talk about environmental issues vaguely may reflect their limited education about environmental issues or a limited ability to correctly categorize them. Rural residents' lack of environmental knowledge was also confirmed in the quantitative analysis.

While young and well-educated Chinese people have higher NEP scores in both rural and urban areas, the most striking residential difference arose in the older and the less-educated groups. The limited environmental knowledge of older and less educated rural people seemed to limit their understanding of environmental risks and make them less likely to assert their right to a clean living environment.

Although my findings regarding rural people's lower concern for the environment is in line with the conclusions drawn in other countries (Arcury & Christianson, 1990; Fransson & Garling, 1999; Tjernstromand & Tietenberg, 2008; Tremblay & Dunlap, 1978; Uzzell, 2000), the reason for the residential gap may be different. The high-quality rural living environment (with amenities and access to education and information) that is common in some developed countries does not exist in China. Instead, lack of access

to formal environmental education constitutes a major barrier for rural residents to fully perceive environmental problems; without a larger understanding of the causes and consequences of environmental woes, rural residents tend to express less concern about the environment. In order to raise environmental concern in rural communities, less-educated populations – especially older people – should be targeted for education. Since the target groups are out of school, one way to enhance their environmental concern might be to provide modularized seminars tailored for older rural citizens.

It is worth noting that, in contrast to findings in some Western countries, income is not a good indicator of environmental attitudes in China. Though the hierarchy of needs model (Maslow, 1954) would suggest that wealthier people have the "luxury" of expressing more environmental concern, in China, low-income people in both rural and urban samples showed similar environmental concern to higher-income groups.

This study also points out two questions to be addressed in future research. First, in China, urban–rural gaps in NEP scores varied across different regions, and the variation seemed to be associated with levels of local resource richness and industrialization. However, further investigation is needed to determine the extent to which availability of natural resources and the presence of industry affect environmental attitudes. Second, although this paper applied Hong's (2005) NEP scale, which has already been adjusted to China's urban context, to measure people's environmental attitudes, some of its items were still difficult for rural residents – especially those with limited education – to understand. In order to expand its utility in China, the NEP scale should be further revised to make it more readily understandable to a broader range of citizens.

Acknowledgment

This article is based on field survey supported by research grants from the Rackham Graduate School of the University of Michigan and the National Natural Science Foundation of China (71073007, 71273022). Many thanks to Professor Dorceta E. Taylor for her constructive comments and editing on an early version of this paper.

References

- Adeola, F. O. (1994). Environmental hazards, health, and racial inequity in hazardous waste distribution. *Environment and Behavior*, 26(1), 99–126.
- Antil, J. H. (1984). Socially responsible consumers: Profile and implications for public policy. *Journal of Macro-marketing*, 4(2), 18–39.
- Arcury, T., & Christianson, E. (1990). Environmental worldview in response to environmental problems: Kentucky 1984–1988 compared. *Environment and Behavior*, 22, 387–407.
- Carlsson, F., & Johansson-Stenman, O. (2000). Willingness to pay for improved air quality in Sweden. *Applied Economics*, 32(6), 661–669.
- China's Statistical Department. (2005). *China National Census Data 2004*, Beijing, China.
- China's Statistical Department. (2008). *China Rural Statistical Yearbook 2007*, Beijing, China.
- Chung, S. S., & Poon, C. S. (1999). The attitudes of Guangzhou citizens on waste reduction and environmental issues. *Resources, conservation and Recycling*, 25(1), 35–59.
- Chung, S. S., & Poon, C. S. (2001). A comparison of waste-reduction practices and new environmental paradigm of rural and urban Chinese citizens. *Journal of Environmental Management*, 62, 3–19.
- Dalton, R. (1984). Cognitive mobilization and partisan dealignment in advanced industrial democracies. *Journal of Politics*, 46(1), 264–284.
- DeGroot, I. (1967). Trends in public attitudes toward air pollution. *Journal of the Air Pollution Control Association*, 17, 679–681.
- Dietz, T., Stern, P., & Guagnano, G. (1998). Social structural and social psychological bases of environmental concern. *Environment and Behavior*, 30, 450–471.
- Dunlap, R. E., & Van Liere, K. D. (1978). *Environmental concern: A bibliography of empirical studies and brief appraisal of the literature*. Vance Bibliographies.
- Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues*, 56(3), 425–442.

- Fransson, N., & Garling, T. (1999). Environmental concern: Conceptual definitions, measurement methods, and research findings. *Journal of Environmental Psychology*, 19(4), 369–382.
- Gao, C., Yin, H., Ai, N., & Huang, Z. (2009). Historical analysis of SO₂ pollution control policies in China. *Environmental Management*, 43(3), 447–457.
- Gelobter, M. (1992). Toward a model of "environmental discrimination". In B. Bryant, & P. Mohai (Eds.), *Race and the incidence of environmental hazards: A time for discourse*. Boulder, CO: Westview.
- Guan, D., Peters, G. P., Weber, C. L., & Hubacek, K. (2009). Journey to world top emitter: An analysis of the driving forces of China's recent CO₂ emissions surge. *Geophysical Research Letters*, 36(4).
- Guo, J. (2001). Eco-culture and sustainable development in minority groups of Yunnan. *Social Science in Yunnan*, 4, 51–56 (in Chinese).
- Hansen, A. (1991). The media and the social construction of the environment. *Media Culture Society*, 13, 443–458.
- Hao, F. (2005). Air condition in rural areas. *Renewable Energy*, 4, 6–7 (in Chinese).
- Harris, P. G. (2006). Environmental perspectives and behavior in China: Synopsis and bibliography. *Environmental and Behavior*, 38(5), 5–20.
- Heberlein, T. A. (1981). Environmental attitudes. *Abhandlungen*, 2(81), 241–270.
- Hirsh, J. B. (2010). Personality and environmental concern. *Journal of Environmental Psychology*, 30, 245–248.
- Hong, D. (2005). Urban citizens' environmental consciousness. *Jiangsu Social Science*, 1, 127–132 (in Chinese).
- Hong, D. (2006). Measurement of environmental concern: Application of the NEP scale in China. *Society*, 26, 71–92 (in Chinese).
- Hu, Y. (2002). Geopolitical cultural basis in the study of the Dynasty Qin and its culture. *Journal of Humanity*, 6, 118–124 (in Chinese).
- Huang, Y. (2008). *Capitalism with Chinese characteristics: Entrepreneurship and the state*. Cambridge: Cambridge University Press.
- Hunter, L., Hatch, A., & Johnson, A. (2004). Cross-national gender variation in environmental behaviors. *Social Science Quarterly*, 85(3), 677–694.
- Huntington, E., & Pan, G. (1933). *Natural selection and national character of Chinese people*. New Moon Bookstore.
- Inglehart, R. (1995). Public support for environmental protection: Objective problems and subjective values in 43 societies. *PS: Political Science and Politics*, 28(1), 57–72.
- Jiang, W., & Zhang, L. (2005). Resources and environmental bases for the development of northwestern China in the 21st century. *Resources Science*, 27(3), 26–32 (in Chinese).
- Karpiak, C. P., & Baril, G. L. (2008). Moral reasoning and concern for the environment. *Journal of Environmental Psychology*, 28, 203–208.
- Kwan, T. Y. L., & Lidstone, J. (1998). Understanding environmental education in the People's Republic of China: A national policy, locally interpreted. *Environmental Education Research*, 4(1), 87–97.
- Lee, J. C., & Tilbury, D. (1998). Changing environments: The challenge for environmental education in China. *Geography*, 227–236.
- Li, X. (2011). Social demographic characteristics and environmental concern: An analysis based on rural data. *China Population, Resources and Environment*, 21(12), 121–128 (in Chinese).
- Li, C., & Xie, H. (2006). Natural resources and environment security in Northeast, China. *Resources Science*, 28(1), 30–36 (in Chinese).
- Lin, Y. (1938). *My country and my people*. Halcyon House.
- Ma, J. (2004). *China's water crisis*. Norwalk: EastBridge.
- Malkis, A., & Grasmick, H. (1977). Support for the ideology of the environmental movement: Tests of alternative hypotheses. *Western Sociological Review*, 8, 25–47.
- Maslow, A. H. (1954). *Motivation and personality*. New York: Harper.
- Merchant, C. (1990). Gender and environmental history. *Journal of American History*, 76(4), 1117–1121.
- Milfont, T. L. (2012). Cultural differences in environmental engagement. In S. Clayton (Ed.), *The Oxford handbook of environmental and conservation psychology*. Oxford: Oxford University Press.
- Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, 30, 80–94.
- Mohai, P. (1992). Men, women, and the environment: An examination of the gender gap in environmental concern and activism. *Society and Natural Resources*, 5(1), 1–19.
- Mohai, P., & Bryant, B. (1998). Is there a race effect on concern for environmental quality? *The Public Opinion Quarterly*, 62(4), 475–505.
- Mohai, P., & Twilight, B. (1987). Age and environmentalism: An elaboration of the Buttel model using national survey evidence. *Social Science Quarterly*, 68(4), 798–815.
- Pan, X., Dong, Z., Jin, X., Wang, B., Wang, L., & Xu, X. (2001). Study on assessment for exposure to air pollution in rural areas. *Journal of Environmental Health*, 18(6), 323–325 (in Chinese).
- Parlour, J. W., & Schatzow, S. (1978). The mass media and public concern for environmental problems in Canada 1969–1972. *International Journal of Environmental Studies*, 13, 9–17.
- Robin, S., & Mohai, P. (2005). Historical context and hazardous waste facility siting: Understanding temporal patterns in Michigan. *Social Problems*, 52(4), 618–648.
- Scott, D., & Willits, F. K. (1994). Environmental attitudes and behavior: A Pennsylvania survey. *Environment and Behavior*, 26(2), 239–260.
- Shen, J., & Saito, T. (2008). Re-examining the relations between socio-demographic characteristics and individual environmental concern: Evidence from Shanghai data. *Journal of Environmental Psychology*, 28, 42–50.
- State Environmental Protection Administration. (1999). The whole China's public environmental consciousness investigation report. *Peoples' Forum*, 7, 21.
- Stets, J. E., & Biga, C. F. (2003). Bringing identity theory into environmental sociology. *Sociological Theory*, 21(4), 398–423.
- Stevens, J. (1984). Satisfaction with environmental change: An empirical analysis of attitudes toward air quality by recent interstate migrants. *Journal of Environmental Economics and Management*, 11, 264–281.
- Tang, M., Zhou, Q., & Kuang, H. (2009). A survey of urban residents' environmental attitude and behavior. *Journal of Xiangtan Normal University (Natural Science Edition)*, 31(1), 149–152.
- Taylor, D. E. (2000). The rise of the environmental justice paradigm: Injustice framing and the social construction of environmental discourses. *American Behavioral Scientist*, 43(4), 508–580.
- The World Bank. (2007). *Cost of pollution in China*. The World Bank, D.C.
- Tjernstrom, E., & Tietenberg, T. (2008). Do differences in attitudes explain differences in national climate change policies? *Ecological Economics*, 65, 315–324.
- Tognacci, L. N., Weigel, R. H., Wideen, M. F., & Vernon, D. T. A. (1972). Environmental quality: How universal is public concern? *Environment and Behavior*, 4, 73–86.
- Tremblay, K. R., & Dunlap, R. E. (1978). Rural–urban residence and concern with environmental quality: A replication and extension. *Rural Sociology*, 43(3), 474–491.
- UNDP (United Nations Development Programme). (2010). *Ningxia anti-desertification and livelihood improvement*. UNDP Project Report. Available at http://www.cn.undp.org/content/china/en/home/operations/projects/environment_and_energy/ningxia-anti-desertification-and-livelihood-improvement/.
- Uzzell, D. L. (2000). The psycho-spatial dimension of global environmental problems. *Journal of Environmental Psychology*, 20, 307–318.
- Van Liere, K. D., & Dunlap, R. E. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public Opinion Quarterly*, 44(2), 181–197.
- Wang, L., & Fu, S. (2011). Application of the NEP scale in rural areas of western China: A case study in northern village of Shanxi province. *Guangdong Agricultural Sciences*, 19, 074 (in Chinese).
- Wang, G., & Jin, Y. (2008). The causes and countermeasures for rural garbage problems. *Modern Economy*, 98, 44–46 (in Chinese).
- Weigel, R., & Weigel, J. (1978). Environmental concern: The development of a measure. *Environment and Behavior*, 10(3), 1–15.
- Whitehead, J., & Blomquist, G. (1991). Measuring contingent values for wetlands: Effects of information about related environmental goods. *Water Resources Research*, 27(10), 2523–2531.
- Wu, Z. (1997). Study of survey and evaluation on residents' environmental awareness. *Shanghai Environmental Science*, 16(7), 13–16.
- Xiao, C., Dunlap, R. E., & Hong, D. (2013). Nature and sources of environmental concern in China. *Social Science Quarterly*, 94(3), 672–690.
- Xiao, C., & McCright, A. M. (2007). Environmental concern and socio-demographic variables: A study of statistical models. *The Journal of Environmental Education*, 38(2), 3–14.
- Xu, G. (2001). Comparative research on conditions of reducing cultivated land to plant forest of Chongqing City. *Journal of Soil and Water Conservation*, 15(6), 81–83 (in Chinese).
- Yang, J. (2008). *Tombstone: An account of Chinese Famine in the 1960s*. Hong Kong: Cosmos Books.
- Zhang, C. (1987). Land use in Sanjiang fluvial plain. *Scientia Geographica Sinica*, 7(3), 287–289 (in Chinese).
- Zhang, B. Y. (1992). *History of Heilongjiang*. Heilongjiang: Heilongjiang People's Publishing House (in Chinese).
- Zhang, Y. (2009). Environmental movements in China. *Green Leaves*, 11, 24–29 (in Chinese).
- Zhang, H., Liu, G., Wu, J., Li, M., & Wu, K. (2001). A survey of residents' environmental awareness in Panyu. *Environmental Technology*, 3, 38–42 (in Chinese).
- Zhang, J., Liu, X., Tan, Z., & Chen, Q. (2012). Mapping of the north-south demarcation zone in China based on GIS. *Journal of Lanzhou University (Natural Sciences)*, 48(3), 28–33 (in Chinese).
- Zhang, Y. Z., & Wu, Q. J. (2006). Statistical analysis of industrialization in China provinces. *Journal of Luoyang University*, 21(4), 1–6 (in Chinese).