

Ahlheim, Michael; Frör, Oliver; Tong, Jiang; Jing, Luo; Pelz, Sonna

**Working Paper**

## Nonuse values of climate policy: An empirical study in Xinjiang and Beijing

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# FZID Discussion Papers

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## **NONUSE VALUES OF CLIMATE POLICY - AN EMPIRICAL STUDY IN XINJIANG AND BEIJING**

**Michael Ahlheim, Oliver Frör,  
Jiang Tong, Luo Jing, Sonna Pelz**

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## **Nonuse values of climate policy - An empirical study in Xinjiang and Beijing**

### **1. Introduction**

Climate policy measures can be roughly subdivided into mitigation measures and adaptation measures. Mitigation policy aims at a reduction of greenhouse gas emissions with the overall goal of slowing down climate change and global warming. Since greenhouse gases like CO<sub>2</sub>, Methane etc. are global pollutants which have the same effect on world climate irrespective of where they are emitted mitigation policy creates benefits for people all over the world. Adaptation policy on the other hand does not seek to influence the world climate but, instead, is meant to reduce the negative consequences of climate change for a specific region. The benefits created by adaptation policy are, therefore, only of local importance while mitigation policy yields global benefits. This difference has, of course, consequences for the welfare economic appraisal of mitigation policy measures as compared to adaptation policy measures. Since the wellbeing of many more people worldwide is affected by mitigation measures than by adaptation measures the former will always appear more attractive in a cost-benefit analysis than the latter, at least from a global perspective.

In this paper we want to show that adaptation policy measures are often undervalued in cost-benefit analyses because only their so-called use values are considered, while the nonuse values they create are neglected. The use value of a commodity accrues from a direct utilization of that commodity. In an environmental context the use value of e.g. a beautiful landscape is felt by those people who visit this landscape. Beyond this use value the landscape might also have a value for people who never visit it but still enjoy the knowledge that in their country such a beautiful landscape exists and that endangered animals and plants are preserved there. This value that originates from the mere existence of a (market or environmental) good is often called its nonuse value because it is independent of a direct (and empirically observable) utilization of this good.

If it can be shown that some adaptation policy measures in the context of climate policy create also nonuse values in addition to the use values this might lead to a new assessment of such measures and it might increase their chances of being approved in the political decision process. It is obvious that the systematic undervaluation of adaptation policy measures resulting from the neglect of the nonuse values they create might have the consequence that they are declined because they do not pass the cost-benefit test, though they create high nonuse values which are not considered in this test. Of course, the existence of nonuse values depends on the cultural background of the people affected by these measures and of the society they live in. Especially in an emerging country like China many people might still underestimate the importance of climate adaptation measures in comparison with economic policy measures triggering the economic growth of the country, especially if the adaptation measures are conducted in faraway regions of the country.

In this study we test empirically the hypothesis that also in a growth-oriented economy like China non-materialistic values like the nonuse values of climate policy are perceived and respected by the population. This should especially hold for the better educated people living in big cities like Beijing. Therefore, we conduct a survey in Beijing where we ask people to assess a climate change adaptation project to be implemented in a faraway region, in this case in the Tarim basin in Xinjiang. In this survey we find that also Beijing citizens feel responsible for the environmental conditions in Xinjiang,

especially under the impression of climate change. We find that they are even willing to contribute personally to financing a public project for the improvement of the living conditions in this remote (as viewed from Beijing) region.

The rest of the paper is organized as follows: the next chapter focuses on the importance of nonuse values in environmental cost-benefit analyses; information concerning the impact of climate change on the Tarim area is provided in chapter three; the survey method and sampling procedure are introduced in chapter four; in chapter five results of the survey in Beijing are presented and analyzed, followed by some concluding remarks.

## **2. Background of the study**

Climate policy is a costly undertaking and adaptation measures aiming at a reduction of the impact of climate change on a certain region are usually financed out of public funds. Before implementing a particular project or policy, decision makers should make sure that this makes sense from a social point of view, i.e. that the social benefits accruing from such a project outweigh its costs. Comprehensive environmental cost-benefit analysis requires that all benefits accruing from a project are included (Mitchell & Carson, 1989). Krutilla (1967) pointed out that people can gain utility from a natural resource without using it. With this observation he introduced the above mentioned concept of the nonuse values of public goods into the discussion on the appraisal of public projects. Following the total value approach both use values and nonuse values need to be assessed for a comprehensive valuation of public goods or projects.

The nonuse value of a natural resource can be disaggregated into its *existence value* (preservation of the resource for its own sake, i.e. in absence of any intention to ever use it), its *option value* (arising from preserving the option of using the natural resource in the future), its *altruistic value* (accruing from the pleasure of knowing that others will enjoy the natural resource) and its *bequest value* (generated by the enjoyment of knowing that future generations can benefit from the natural resource). In contrast to the use values that can only be enjoyed by the direct users of an environmental resource, e.g. people living on site, nonuse values can also be experienced at a distance (Figure 1). This latter feature of nonuse values has important consequences for environmental cost-benefit analysis.

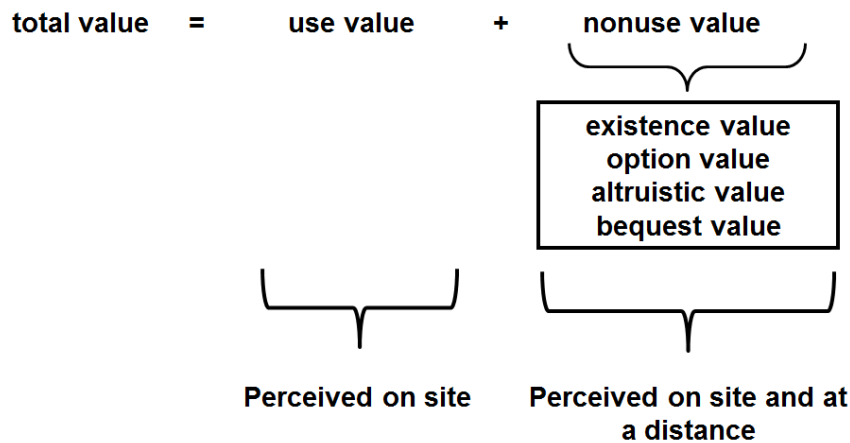


Figure 1: *The total value of an environmental resource*

The social benefits generated by an environmental project are calculated as the sum of the changes in the utility of all households affected by this project. As a consequence, social benefits depend both on the increase of wellbeing of individual households and on the number of households considered. Thus, a critical question is to decide on the relevant population when assessing social benefits (Hanley, Schläpfer, & Spurgeon, 2003). In many cases, the impacts of global climate change are most serious in scarcely populated regions. The high costs of public projects could not be justified only by the benefits accruing to people directly affected, because the aggregated benefits would be very low due to the small number of households affected. However, due to its nonuse values, not only people on site but also those living far away might obtain benefits from projects leading to improved environmental conditions. Future generations are often the main beneficiaries of climate policy, so that the bequest value is likely to be quite high. As explained above, considering only the benefits enjoyed by local people would lead to a dramatic underestimation of the social value of a public project and thus to misleading results of the environmental cost-benefit analysis.

This study aims at the assessment of the nonuse value of a more sustainable water and land management in the Tarim River Basin in Xinjiang province in Northwest China. In developing and emerging countries household budgets are often tight, traveling is luxury and for many households economic prosperity matters more than environmental protection. Thus, the question arises whether people in China perceive so-called nonuse values at all. The urban population of Beijing has been chosen as an example for people indirectly affected by the environmental project under consideration. Using the contingent valuation method (CVM) the benefits of improved environmental conditions in the Tarim basin experienced by this population was calculated in monetary terms.

### 3. The project area

The Tarim River, located in an arid desert region in Northwest China, is the longest river in Central Asia. The natural environment as well as most economic activities and settlements in the Tarim basin directly depend on water from the Tarim River (Thevs, 2011). Since the 1950s agricultural activity, especially the extremely water intensive production of cotton, has expanded and the population in

the oasis cities along the Tarim River has grown considerably. As a consequence, the Tarim River loses water as it flows downstream and the lowest parts of the downstream river reaches are completely desiccated due to the extensive exploitation of river water in the upper reaches. The dramatic loss of water resources in the lower reaches has led to a severe deterioration of the highly vulnerable riparian ecosystems, desertification and loss of biodiversity, negatively affecting the living conditions of local people and the development of the entire region. Due to the predicted impacts of climate change, i.e. increasing temperatures, changes in seasonal precipitation and glacier melting, the problem of water shortage will become more and more serious and the effects on the entire region will be disastrous (Chen, Xu, Chen, Liu, & Li, 2013). Worst-case scenarios predict the complete desiccation of the Tarim River leading to a merging of the Taklamakan desert into the southern part of the Gobi desert, the so-called Kuruk desert.

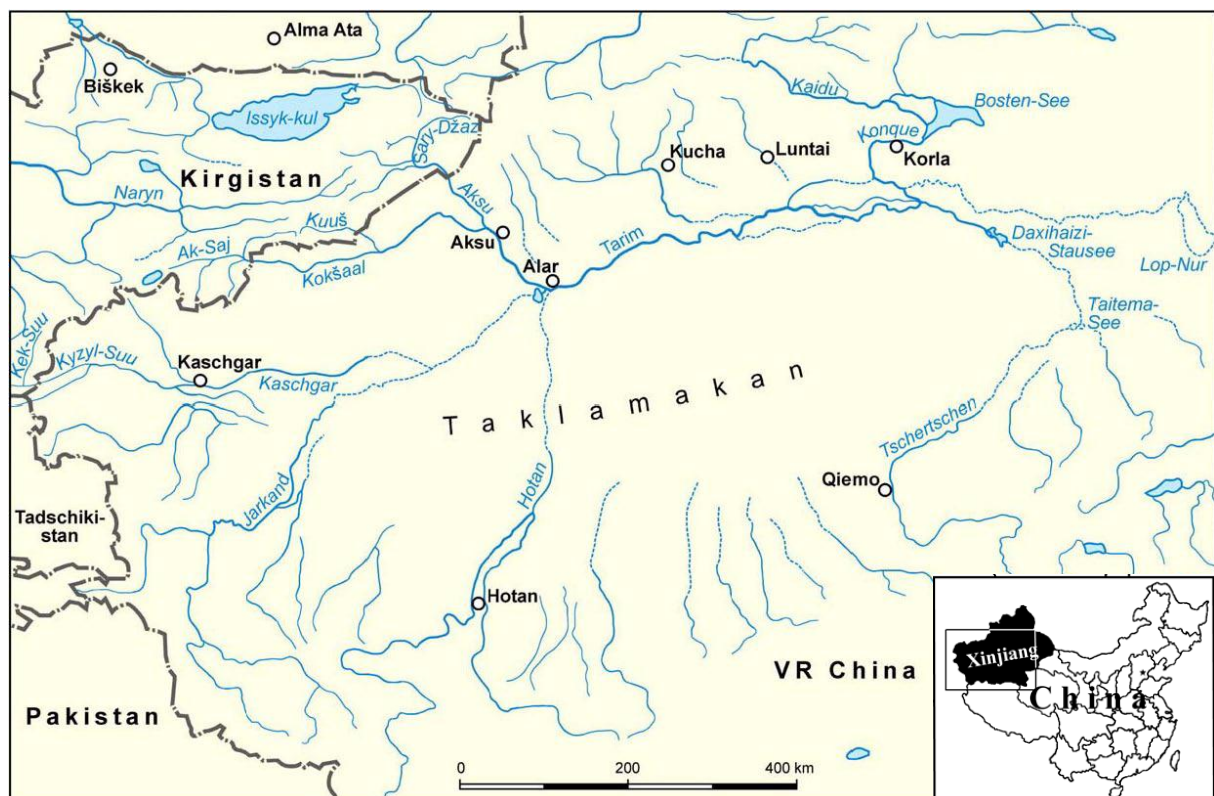


Figure 2: Map of the Tarim basin and its location in Northwest China (SUMARIO, 2010)

The environmental problems of the Tarim basin have been extensively studied by Chinese and foreign researchers and since the turn of the century the Chinese government has heavily invested in projects aimed at improving the situation. Furthermore, two World Bank projects (1991-1997 & 1998-2005) led to improvements of the water distribution infrastructure and the establishment of mechanisms for sustainable water management in the region (World Bank, 2007). However, water shortage remains a problem and the environmental deterioration in the lower reaches of the Tarim is progressing (Tao, Gemmer, Song, & Jiang, 2008). An integrated river basin management, in particular an improved water management and, in conjunction, a more sustainable land management, is urgently needed (Chen et al., 2013). Once fully implemented a more sustainable management scheme would considerably increase the living conditions of local people by providing secure water supply and better agricultural conditions in the lower reaches of the Tarim River. Further, the landscape in the lower reaches of the Tarim River would become more beautiful, the extinction of

typical plants and animals could be prevented, desertification could be stopped and the area would therefore be preserved for future generations. Thus, the new management scheme would generate several use and nonuse values.

It is clear that the scientific development, the implementation and the maintenance of such a management scheme are very costly and that it will require further investments by the Chinese Government. An important question is whether these high costs can be justified from a social point of view. Environmental cost-benefit analysis can be used by decision makers in order to decide whether this climate adaptation policy should be implemented or not.

#### **4. The survey**

##### **4.1. The Contingent Valuation Method**

In an environmental economic assessment costs and benefits, expressed in monetary terms, need to be compared to each other. Whereas the economic cost of projects in the environmental sector can be calculated based on market prices, the assessment of its benefits accruing to society as a whole is more challenging. Changes in social welfare due to a change in environmental quality are not reflected by market prices and have to be estimated using environmental valuation methods.

The Contingent Valuation Method (CVM) is widely accepted and the most popular technique for the evaluation of public projects in the environmental sector (Carson & Hanemann, 2005). The CVM is an interview-based method where a representative sample of households affected by an environmental project is asked to state their willingness to pay (WTP) for the realization of that project. It is assumed that a household's WTP reflects the utility it gets from the implied environmental improvement in monetary terms. The sum of the individual WTPs of all households affected equals the overall social value of the environmental improvement. In practice, the overall social value is calculated by multiplying the average WTP of a representative household sample by the number of all households affected. In contrast to indirect valuation methods, such as the travel cost method or the hedonic price method, CVM allows for a comprehensive measurement of both use values and nonuse values (Ahlheim & Frör, 2003).

Because of its suitability for the estimation of the total economic value of public projects in the environmental sector, the CVM is a powerful assessment instrument in the context of climate adaptation policy. In addition to measuring social benefits in monetary terms, factors determining a household's WTP (e.g. household size, income, etc.) as well as environmental attitudes of the respondents are investigated in a CVM study. As highlighted by Deng, Qin, and Zhang (2012) understanding the public view on climate adaptation and mitigation measures is essential in the overall context of climate policy.

##### **4.2. Sample population, questionnaire design and sampling method**

The water and land management project considered in this study is thought to increase the wellbeing of people living on site (e.g. in the Tarim basin) and also of people living far away due to its nonuse values. This paper focuses on the nonuse values experienced by households indirectly affected by the project and therefore only investigates the view of people living far away from the project area.



The city of Beijing was chosen as a study site because its residents may be viewed as representing the population indirectly affected by the water and land management project in the Tarim area. Because of the relatively small sample size ( $n=303$ ) only adults currently living in one of the six urban districts of Beijing were sampled.

The questionnaire was jointly designed by Chinese and German researchers based on interviews with experts in the field of water and land management in Xinjiang and on in-depth interviews with Beijing citizens. Prior to the main survey, different versions of the questionnaire were thoroughly pretested (100 pretest interviews in total). In addition, several citizen expert group (CEG) workshops were held. Citizen experts are “normal” people, i.e. no scientific experts, representing their fellow citizens. CEGs are very useful in adapting CVM surveys to the specific socio-cultural context of the survey population. Well-designed CEG workshops can help to minimize biases in CVM studies (Ahlheim et al., 2010). The questionnaire was steadily adapted based on information and suggestions obtained from the CEGs.

The final questionnaire was structured in five parts, containing (1) demographic questions, (2) warm-up questions concerning prior knowledge of the Tarim basin, (3) a third part containing a detailed description of the environmental and social problems resulting from water shortage, the project and the payment scenario, and the WTP elicitation question, (4) several follow-up questions on environmental issues, and (5) questions on household data. In order to increase the response rate, respondents were offered a monetary compensation of 30 RMB (about 3.80€) for their effort.

Since conventional household interviews were not possible for reasons of safety 18 students of the University of Nationalities in Beijing conducted intercept face-to-face interviews in the surroundings of six subway stations in July 2012. The subway stations Dongzhimen, Xizhimen, Liujiayao, Guomao, Renmin Uni and Weigongcun were chosen in order to access different groups of the population in different districts of the city. Interviews were not conducted directly at the subway station, but at suitable places such as cafés, restaurants, public parks, etc. Quota for gender, age and education based on official data from the Beijing Municipal Bureau of Statistics (2012) were employed in order to ensure representativeness of the sample. Out of 305 questionnaires, only two questionnaires had to be discarded, leading to 303 valid questionnaires.

## **5. Results and discussion**

### **5.1. Sample composition**

The average WTP obtained from the CVM survey can be interpreted as an adequate estimate of the WTP of all households living in the urban districts of Beijing only if the sample is representative of this population. The third column in Table 1 shows the socio-demographic characteristics of the survey sample. For comparison, official statistical data is provided in the fifth column. Since the data of the sample is very similar to the official data, it can be concluded that the sample is representative.

Table 1: Socio-demographic characteristics of survey sample

| Variable                                    |                                 | Sample<br>(n=304) | 95% Conf. interval          | Beijing<br>Statistical<br>Yearbook<br>2011 <sup>1</sup> |
|---|---------------------------------|-------------------|-----------------------------|---|
| Gender                                      | male                            | 53.0%             | [47%; 59%]                  | 52.0%   |
|   | female                          | 47.0%             | [41%; 53%]                  | 48.0%   |
| Age   | 18-29                           | 30.3%             | [25%; 36%]                  | 29.7%   |
|   | 30-39                           | 21.4%             | [17%; 26%]                  | 21.0%   |
|   | 40-60                           | 34.2%             | [30%; 41%]                  | 34.6%   |
|   | < 60                            | 14.1%             | [9%; 17%]                   | 14.6%   |
| Education                                   | Without or elementary education | 10.9%             | [7%; 14%]                   | 12.3%   |
|   | Middle education                | 54.9%             | [49%; 60%]                  | 54.9%   |
|   | Higher education                | 34.2%             | [29%; 40%]                  | 32.8%   |
| Ethnicity                                   | Han                             | 94.7%             | [92%; 97%]                  | 95.9%   |
|   | Minorities                      | 5.3%              | [3%; 8%]                    | 4.1%  |
| Disposable<br>annual<br>household<br>income |                                 | 83 621<br>RMB     | [73 714 RMB;<br>93 528 RMB] | 81 404 RMB <sup>2</sup>                                 |
| District of<br>residence                    | Dongcheng                       | 11.2%             | [7%; 14%]                   | 7.8%  |
|   | Xicheng                         | 9.87%             | [7%; 13%]                   | 10.6%   |
|   | Chaoyang                        | 24.3%*            | [20%; 30%]                  | 30.3%   |
|   | Fengtai                         | 19.4%             | [15%; 24%]                  | 18.0%   |
|   | Shijingshan                     | 1.6%*             | [0.2%; 3%]                  | 5.3%  |
|   | Haidian                         | 33.6%             | [28%; 35%]                  | 28.0%   |

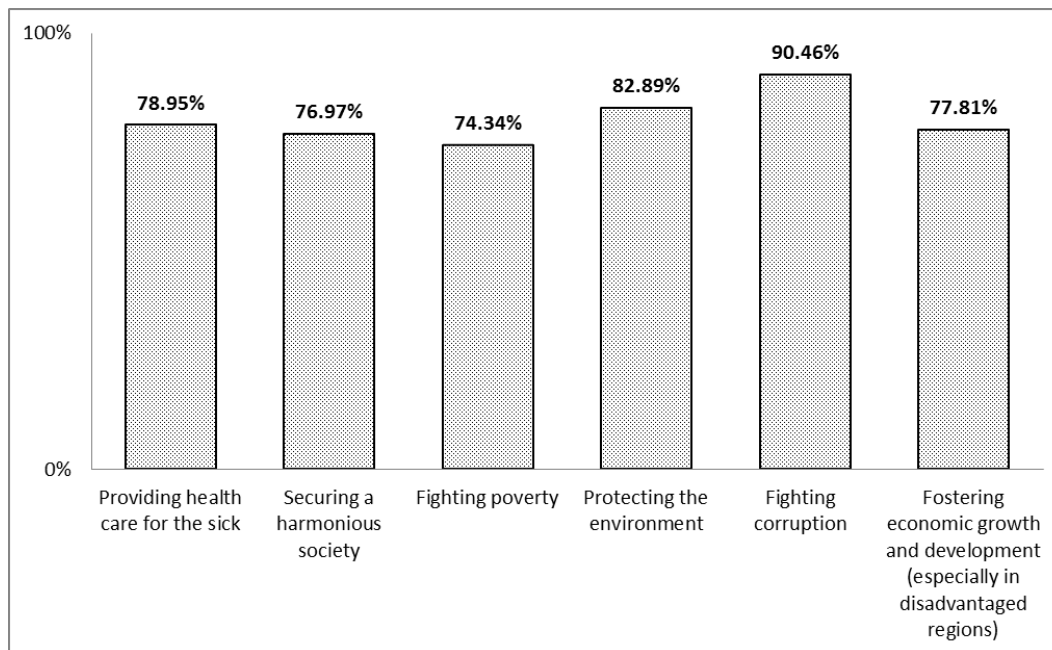
<sup>1</sup>: Beijing Municipal Bureau of Statistics (2012)

<sup>2</sup>: Average annual disposable income per capita multiplied by the average family size

\*: Sample characteristics that are statistically different from the official data

## 5.2. The attitude of Beijing citizens towards environmental deterioration in the Tarim Basin

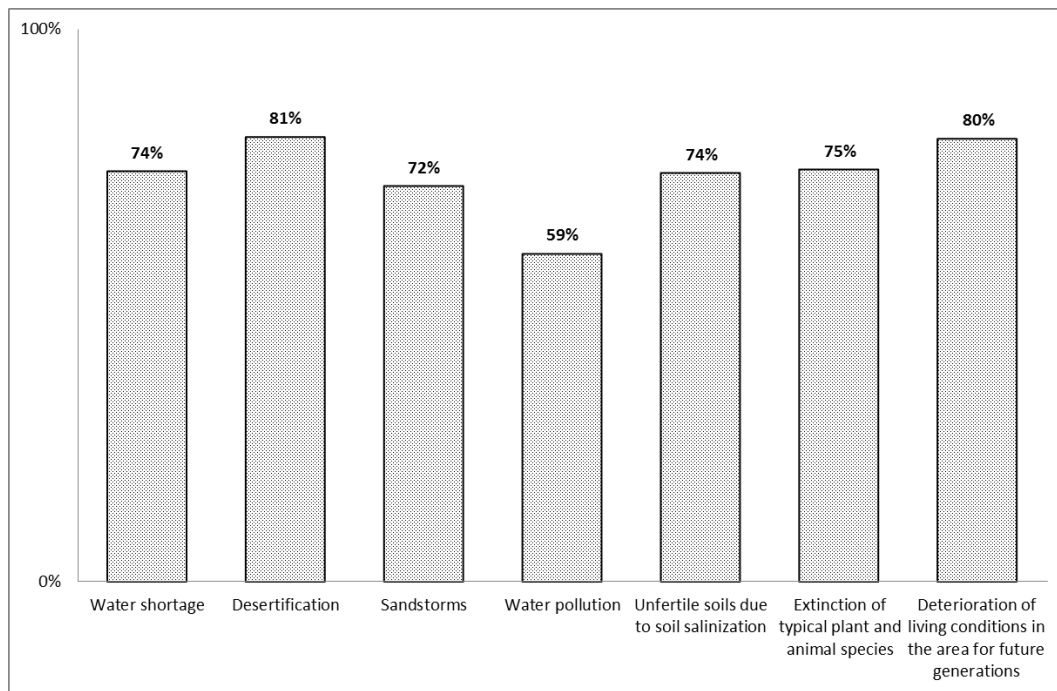
The attitude of Beijing citizens towards environmental problems in general and the environmental problems in the Tarim basin in particular was investigated in this survey. A general awareness of the need of protecting the environment can be seen as a precondition for the valuation of an environmental improvement occurring at distance and generating mainly nonuse value for the respondents in the sample. Interviewees were therefore asked to judge the importance of different tasks of the Chinese government. As can be seen from Figure 3 environmental protection is viewed as the second most important task of government. It can be inferred, that people living in Beijing are very concerned about environmental problems in general. According to the majority of respondents, environmental protection should be given priority even over economic growth and over fighting poverty.



**Figure 3: Public perceptions on the most important tasks of government**

Percentage of respondents who answered “agree” or “strongly agree” to the survey question “Considering several fields of government activities, how important do you find the following tasks of government.”

During the interviews respondents were provided with a detailed description of the causes and consequences of environmental problems occurring in the Tarim basin. Afterwards they were asked how serious they found these problems. All seven problems listed were seen as very serious or extremely serious by the majority of respondents. Desertification of the landscape, the living conditions of future generations and extinction of typical plants and animal species are considered the three most urgent problems (cf. Figure 4). Note that 97% of people have never been to the Tarim Basin and only 6% have relatives living in this area. In other words, the vast majority is not directly concerned by these issues. Therefore, high concern for the natural conditions as well as for future generations can be seen as an indicator that Beijing citizens experience nonuse values when thinking of environmental improvements in the Tarim area.

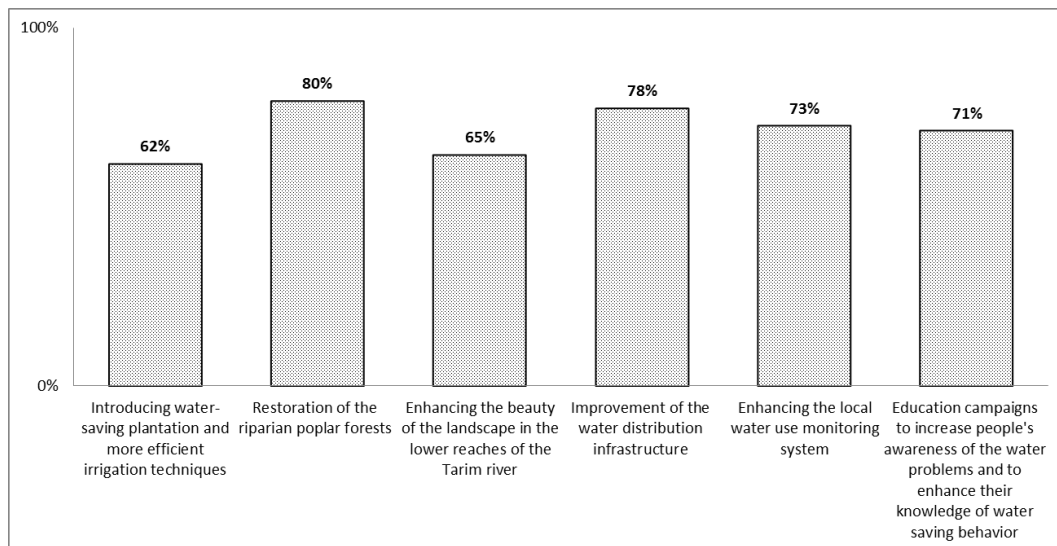


**Figure 4: Public perceptions of environmental problems in the Tarim Basin**

Percentage of respondents who answered “agree” or “strongly agree” to the survey question “*In your opinion, how serious do you find the following problems occurring in the Tarim River Basin?*”

### **5.3. Beijing citizens' attitude towards a more sustainable water and land use management in the Tarim area**

After the description of the problem of water shortage and its impacts the project scenario was read out by the interviewers. It was highlighted how a more sustainable water and land management project would lead to improved environmental conditions in the Tarim basin and how it would mitigate the severe impacts of global climate change. Some of the mitigation and adaptation measures of this project were explained in more detail. Next, respondents were asked to state their opinion concerning the importance of these measures (Figure 5).



**Figure 5: Public opinion on selected policy measures of a more sustainable water and land management**

Percentage of respondents who answered “important” or “very important” to the survey question “How important do you find the different measures to improve environmental conditions in the Tarim River area?”

Note that judging rather technical measures aimed at improving environmental conditions in an area located far away is not an easy task for survey respondents. The results reported in figure 5 should not be interpreted as a recommendation for decision makers concerning the implementation of mitigation and adaptation measures. However, some conclusions concerning the preferences of the population living far away from the Tarim basin can nevertheless be drawn. Beijing citizens stated a preference for the two short-term measures, namely afforestation and improvement of the water distribution infrastructure. Measures that are likely to take longer before being effective (education campaigns, enhancing the beauty of landscape) are less popular among the respondents. The relatively low importance ascribed to water-saving plantation and the improvement of irrigation techniques is at odds with the results by Deng, Qin, and Zhang (2011) from a study in the Ürümqi River Basin, where a very similar adaptation measure was ranked as most important by local residents. However and in accordance with the results of the Beijing survey, improvements of the water distribution infrastructure was the second most-preferred adaptation measure in this same study.

Finally, respondents were asked whether they personally would be willing to make a financial contribution in order to get the sustainable water and land management program in the Tarim area implemented. They were told that the implementation of the program depended on the WTP of every household in China. Only if the total contribution of all Chinese households covered the costs, the project could be implemented. They were asked to select the maximum monthly amount that their household would be willing to contribute over the next ten years from a payment card, i.e. from a list of ascending payment intervals (see Figure 6: *Distribution of WTP* Figure 6). 23% of the respondents stated a zero WTP. Figure 6 shows the distribution of the positive WTP statements.

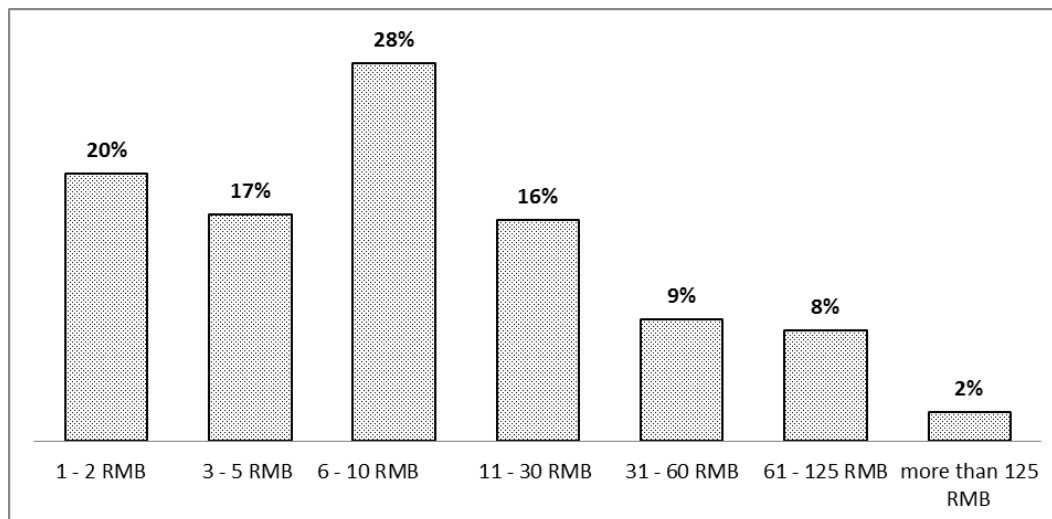


Figure 6: *Distribution of WTP*

The majority of households with a non-zero WTP wants to pay 10 RMB per month or less. The average WTP, calculated based on the midpoints of the payment card intervals, is 16.50 RMB. Considering the purchasing power of Beijing households and the time span of this monthly payment (ten years), this amount can be interpreted as a considerable contribution to an environmental project generating exclusively nonuse values to a population living far away from the Tarim area.

#### 5.4. Nonuse value of a more sustainable water and land use management in the Tarim area

Since a more sustainable water and land management in the Tarim area does not directly affect the citizens of Beijing, the mean WTP of 16.50 RMB can be interpreted as the monetary equivalent of the nonuse values experienced by the survey respondents.

Survey results indicate that the majority of respondents attribute a high importance to the improvement of the living conditions of future generations, the prevention of desertification and the protection of plants and animals (cf. Figure 4). Thus, WTP seems to reflect both existence and bequest values. In addition, the existence of altruistic preferences was tested using several follow-up questions subsequent to the elicitation question. For instance, 73% of the respondents that had stated a non-zero WTP agreed or strongly agreed with the statement *“I feel that we should do something to help the people in the Tarim area and I am glad that I now have the opportunity to do that”* and 69% said *“I want to contribute to the water management program because local people will live an easier and happier life if it will be realized”*.

At the end of the interview, respondents were asked whether they wanted to keep the 30 RMB they were offered as a compensation for participating in the interview, or if they wanted to donate the money to people living in the Tarim area. 59% of the respondents donated their gift. High agreement to the follow-up questions on altruistic preferences as well as the considerable number of respondents willing to make a donation to the Tarim area indicate that Beijing residents' stated WTP for the climate adaptation measures in the Tarim area encompasses altruistic motives.

During test interviews and CEG meetings it became clear that the Tarim area is not a popular tourist destination for Beijing citizens. Accordingly, the option value of improved environmental conditions

in the Tarim area is likely to be quite low. The survey results confirm what was found during in-depth interviews and CEG meetings: only 4% of the respondents had ever been to the Tarim area; among these respondents only four stated touristic motives as reasons for their stay. Thus, the WTP of Beijing citizens mainly reflects the existence value and bequest value of improved environmental conditions in the Tarim area as well as altruistic preferences.

Critics frequently address the hypothetical response bias in CVM studies leading to an overstatement of WTP (cf. e.g. Hausman, 2012). The existence of a hypothetical bias can be checked by comparing stated WTP with actual behavior of respondents. As explained above, in this study we offered respondents the chance to donate the money we had given them as a compensation for participating in our interviews. This donation would benefit people in the Tarim area directly. While the share of people willing to donate “real” money to the Tarim area was lower than the share of people willing to pay for the climate adaptation measures in the hypothetical setting (59% and 77% respectively) the amount of the donation (30 RMB) was almost twice as high as the stated average monthly WTP (16.50 RMB). Thus, the donation experiment provides at least some evidence that the majority of respondents in Beijing is *indeed* willing to give up some money for the wellbeing of people living in the Tarim area. This fact can be seen as an indication that there exist altruistic feelings of Beijing residents towards people living in the Tarim area. This finding makes the existence of nonuse values of climate change adaptation measures in the Tarim basin plausible and lets our WTP results appear realistic.

Summing up, the WTP of Beijing citizens for an environmental improvement without any direct effect on their wellbeing shows that nonuse values are also perceived by people in emerging countries like China. Not accounting for them would lead to an underestimation of the social value accruing from environmental projects, especially in the context of climate policy.

## 6. Concluding remarks

The existence of nonuse values of environmental improvements increases the social value of environmental projects beyond their mere use values. The fact that nonuse values might be experienced even by people living far away from the project area is especially important for the assessment of public projects in sparsely populated regions where use values are rather small. For a comprehensive assessment of the overall value of such projects also people living in regions far away from the project site must be surveyed in order to assess the nonuse values they might obtain from the environmental project in question.

In this study it was found that a more sustainable water and land management leading to an improvement of the environmental situation in the Tarim basin under the impression of future climate change is also welcomed by people living in Beijing.<sup>1</sup> Their willingness to contribute financially to an improvement of the natural environment in the Tarim area can be explained by the existence of nonuse values. People in Beijing are very concerned about the impending environmental deterioration in Northwest China as a consequence of climate change, particularly with a view on

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<sup>1</sup> One limitation of this study is the rather small sample size. Due to the low number of observations no regression analysis was conducted and therefore no conclusions concerning the impact of indicators for nonuse values on WTP can be drawn.

future generations, the desertification of the landscape, loss of biodiversity and the welfare of local people. These results indicate that for a comprehensive assessment of climate adaptation projects in China also the preferences of people living in regions far away from the project site should be considered for the decision if such a project is worthwhile implementing from a social welfare point of view.

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Fruwirthstr. 12

D-70593 Stuttgart

Phone +49 (0)711 / 459-22476

Fax +49 (0)711 / 459-23360

Internet [www.fzid.uni-hohenheim.de](http://www.fzid.uni-hohenheim.de)