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Getting people involved – a preference-based approach to water policy in China

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Getting people involved – a preference-based approach to water policy in China

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Abstract:

Market-oriented environmental policy instruments like taxes and fees or regulatory policy instruments like rationing are typically recommended in order to set incentives for citizens to make a sparing use of water. What is often overlooked in this context is that these instruments provoke resistance and non-compliance of citizens if they do not share the values underlying such a policy. Enforcing compliance with environmental policy instruments requires strict monitoring and the prosecution of trespassers and can be rather costly for government. The resistance to government policy and the incentives to avoid or evade the respective policy measures are the greater the less these instruments are in accordance with people's preferences, i. e. the less people accept these instruments and the goals they serve as reasonable. Compliance enforcement costs are mainly monitoring costs to identify trespassers and administration costs for their prosecution. This paper deals with possibilities to reduce such compliance costs by closing the gap between people's preferences on the one hand and government policy on the other in the case of water preservation in China.

1. Introduction

China faces severe water supply problems in many parts of the country. This is especially true for the arid areas of Western China but also for the big cities like Beijing. These problems refer to water availability as well as to water quality, since reduced precipitation and ensuing desertification as well as dramatically increasing pollution of surface water can be observed in many regions of China. This situation will become even more desperate in the future under conditions of global warming if no measures towards a more sustainable water management are taken. Such measures might comprise traditional instruments of regulatory policy like rationing or economic instruments of environmental policy like taxes, subsidies or tradable water use rights. The compulsory character of these instruments creates incentives for citizens to evade them secretly, thereby rendering them ineffective and inefficient. In order to reduce the resistance of people to water protection policy it is important to include them in the design of such a policy. This can be done by environmental education on the one hand or by orienting the design of environmental policy towards people's preferences on the other. This paper deals with the possibilities of using such participatory elements for a sustainable water protection policy.

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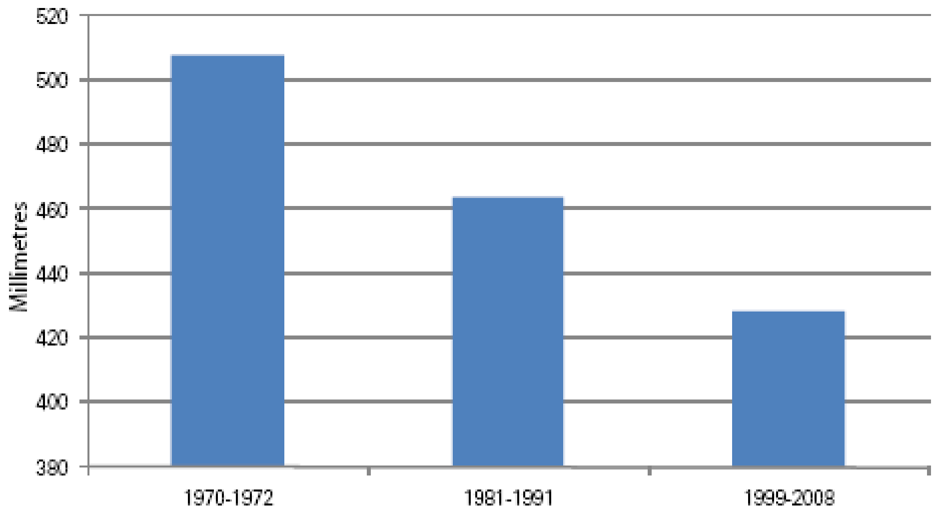
The paper is organized as follows: In the next section the actual and future water problems of China are elaborated in detail in order to give an impression of the dimension of these problems. Section 3 presents shortly the traditional instruments of water policy while in section 4 the possibilities to involve citizens in water preservation policy are discussed. In section 5 an empirical example for the assessment of people's preferences for environmental policy is presented and section 6 contains some concluding remarks.

2. Problems of water supply in China

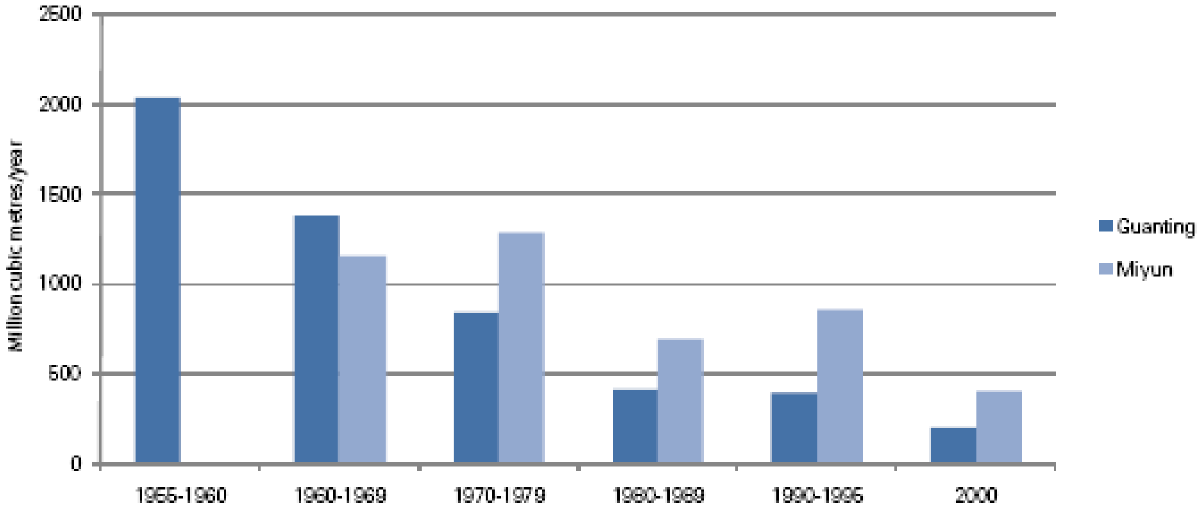
As mentioned above water shortage and water pollution belong to the most pressing environmental problems in China, especially in Western China. Average annual precipitation has declined over the past decades in many parts of the country (cf. fig. 1) while water usage and water pollution have increased dramatically. Water runoff has significantly decreased over the past thirty years, especially in the mountainous regions of North-west China which represent the most important source of water supply for North China. Besides the decrease in precipitation major changes in land-use (like e. g. building of dams, intensive agriculture, industrialization, sealing off of the ground by new buildings, roads etc.) are responsible for this development. As a consequence the big water reservoirs receive less and less inflow and are more and more depleted in order to secure the water supply of the big cities like Beijing, wetlands and river beds fall dry (cf. Probe International Beijing Group 2008, p. 7 ff.). This development has dramatic ecological, economic and social consequences. The ecosystems in the former wetlands change radically, biodiversity decreases, ecosystem functions (ESF) and ecosystem services (ESS) are reduced. This can be observed e. g. in the great river basins like the Hai He basin (cf. Xia et al. (2007, p. 235) or the Tarim River Basin in Xinjiang.



(Source: Probe International Beijing Group 2008, p. 6)

- Fig. 1: Average annual precipitation in the region of Beijing -

In the Hai He basin area surface water is getting scarcer as a consequence of an increasing industrialization and increased domestic water consumption while precipitation has decreased during the last years. This development leads to a reduced inflow of water into Beijing's two largest reservoirs Guanting and Miyun (cf. fig. 2) and to water shortage along the rivers leaving these reservoirs. In order to secure the water supply for Beijing in spite of the reduced availability of surface water an increasing part of Beijing's water supply has been satisfied by extracting groundwater during the last decades. Today already 70 to 80% of Beijing's water supply is covered by ground water. At the moment the main part comes from shallow groundwater sources which normally can be replenished rather easily in the short run. Shallow groundwater on the Beijing plain is recharged 44% by precipitation and 31% by seepage of surface water (Probe International Beijing Group 2008, p. 7). Since both have decreased dramatically during the last decades the recharge of shallow groundwater has also diminished and water authorities have started to drill new and deeper wells and extract ever-deeper groundwater in order to satisfy Beijing's water supply. Today even from so-called karst aquifers at depths of more than 1,000 meters, which are typically protected and saved for times of emergency, groundwater is extracted. Further, water use in upstream Hebei has been restricted and even the surface water flow to downstream Tianjin has been blocked and diverted towards Beijing. This, of course, has dramatic consequences for the ecosystems and the supply of ESS in the affected areas (cf. e. g. Liu / Yo 2001).



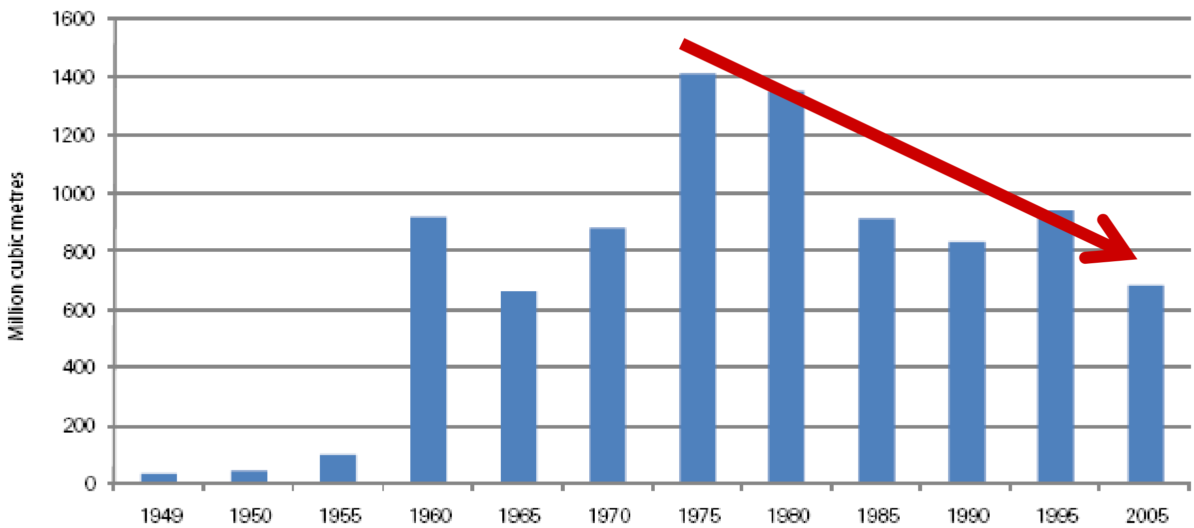
(Source: Probe International Beijing Group 2008, p. 6)

- Fig. 2: Water inflow in Guanting and Miyun reservoirs -

In the Tarim River basin in Xinjiang economic activity depends to high degree on the water coming in from the Tarim's tributaries from the glaciers. The floodplain forest biodiversity along the river depends on the incoming water as it provides valuable ESF and numerous ESS. Humans modify this system by steeply increasing water extraction from the Tarim River for cultivating cash crops. This unsustainable use unhinges the socio-economic structure of the region through altered lifestyles and consumption patterns, especially under the conditions of global climate change. Water scarcity caused by an unadapted agriculture dramatically exacerbates these problems. Eventually, land management decisions must also consider likely secondary effects in other regions: The Xinjiang Province contributes about one third of China's national cotton production. Any considerable changes of this cotton area will have secondary effects in other major cotton producing regions of China (mainly located in the North China Plain) and on the ESS and ESF accruing from them. Land management decisions, e. g. opening land for irrigated agriculture and graze, or harvesting of natural ecosystems, alter the provision of ESF and ESS. The developments in the two regions described here are not isolated special cases but rather typical examples for the water problems and the resulting consequences for ecosystems arising in many other regions of China.

The water shortage problems are accompanied by a dramatic decline in water quality due to severe pollution of surface water in rivers and lakes all over China. The waste water discharge in the Hai He basin for example reached about 6 billion tons per year lately (cf. Xia et al. 2007, p. 236). The deterioration of surface water quality and, as a consequence, of shallow groundwater quality is to a great extent due to the fast industrialization of China with which the building of waste water treatment facilities has not kept pace. Other important factors for the increasing water pollution are inept agricultural techniques implying an overuse of fertilizers and pesticides which are swept into the surface water in rivers and lakes or seep into the groundwater. Further, the greater part of domestic sewage is still released untreated into public waterways or directly into the ground.

The problem of water quality cannot be considered separately from the problem of soil contamination, e. g. by inadequate agricultural practices, since soil and water pollution are closely related with each other. Contaminated surface water seeping into the ground contaminates the soil, while on the other hand noxious particles in the soil might leach into the groundwater.[1] Toxic substances in the surface water of rivers or lakes and in the groundwater influence human wellbeing in many different ways. They affect human health since they are diffused all over the eco-system but they may also impair aesthetic values of a landscape, for example if they lead to a eutrophication of lakes and rivers. Toxic substances in the water are taken in by humans directly with the drinking water and indirectly with the food, since they are contained in agricultural products like fruit, vegetables and cereal products but also in meat and in fish. Therefore, clean water policy is an important task of regional policy for the sustainable development of a region.



(Source: Probe International Beijing Group 2008, p. 18)

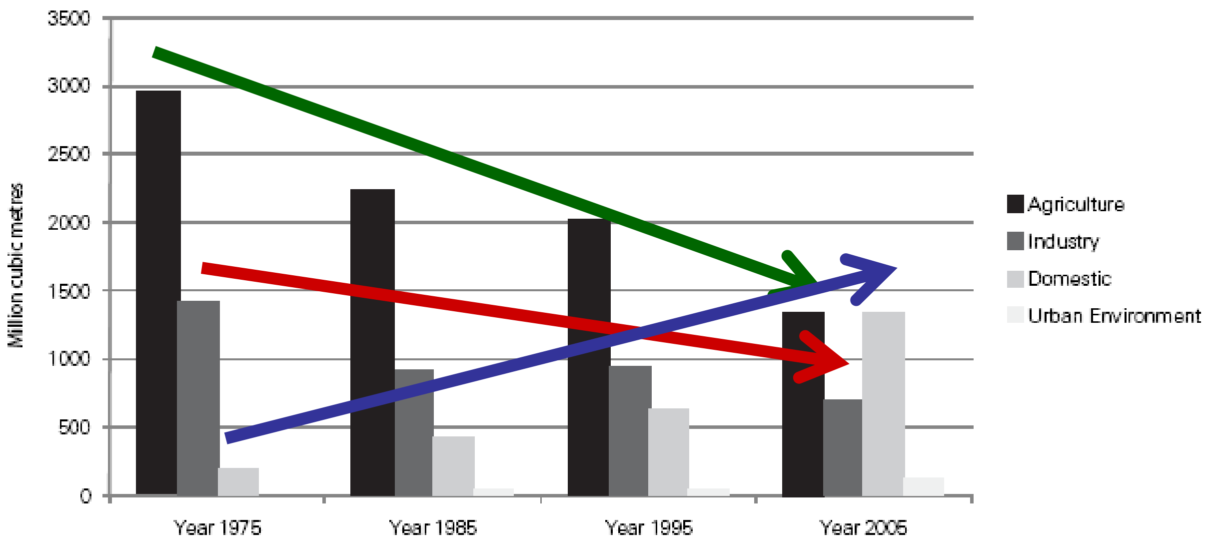
- Fig. 3: Industry water consumption in the Beijing area -

Coming back to the quantity problem of water supply it is interesting to note that e. g. in the Beijing region, the amount of water used for agriculture has dropped by more than one-

[1] For a more extensive discussion of the water pollution problem see Tietenberg 2006, p. 446 ff.

half since 1975 due to more efficient irrigation techniques and to a reduction of irrigated farmland. Furthermore, industrial water use has been reduced considerably as a consequence of the use of water-saving technologies leading to a higher overall water use efficiency in the whole production sector (cf. fig. 3).

Things look different when water consumption by private households is considered. As can be seen from fig. 4 private domestic water consumption in Beijing has risen dramatically since 1975. Tap water use in Beijing has increased from 7 million cubic meters in 1950 to 466 million cubic meters in 1995 and has further increased since then (cf. Probe International Beijing Group 2008, p. 50). This dramatic increase is due to the fast growth of Beijing's population but also to changes in lifestyle which lead to an increase of the daily per capita water consumption from 0.018 cubic meters in 1950 to 0.302 cubic meters in 1995 (Probe International Beijing Group 2008, p. 50).



(Source: Probe International Beijing Group 2008, p. 14)

- Fig. 4: Water consumption in the Beijing area for different sectors -

From these observations it becomes obvious that any water protection policy pursued by the government has to address not only the industrial and agricultural sector but also private households since their water use is far from sustainable as it seems. In the next section the options for a sustainable water preservation policy are shortly reviewed.

3. Instruments of sustainable water policy

In the previous section it was shown that sustainable water preservation policy has to address two different dimensions of the water supply problem: a quantity problem, i. e. dealing with actual and future water shortage, and a quality problem, which means reducing actual and future water pollution.

As explained above government policy for the protection of surface water quality is also a policy for the protection of soil (and of groundwater) while, on the other hand, the protection of soil from pollution with noxious particles etc. also protects the ground water. An effective water and soil protection policy will combine regulatory ("command & control") instruments of environmental policy on the one hand and market instruments like taxes and fees on the other. Political regulation in this field is relatively straightforward as long as the pollutants in question are discharged from a point source like industrial production plants, municipalities or farms since polluters can be identified and addressed directly rather easily in such cases. Things become more complicated if we have to deal with pollutants like fertilizers or pesticides that stem from so-called nonpoint sources. We shall confirm our discussion here to pollution by point sources.

Sustainable water protection policy entails on the one hand measures to reduce the effluent quantity of waste water and on the other hand measures to clean waste water before it is discharged into the environment (rivers, lakes etc.). Since waste water treatment plants show significant economies of scale it does not make sense to force polluters to clean their own sewage individually. It is much more efficient if municipalities build large treatment plants and communal sewer networks to which households and smaller firms are forced to get connected. Big industrial firms with hazardous special waste, of course, have to operate their own treatment plants.

Mandatory connection of all households and production plants to communal waste water treatment plants belongs to the regulatory or command & control policy instruments of water preservation which also comprise the possibility of defining and enforcing strict upper limits for the contents of pollutants in industrial sewage or even rationing water supply to different users by water regulators. Further, the application of certain substances which contaminate sewage when used in production could be regulated by government or even banned (e. g. certain kinds of fertilizers or pesticides). Most of all it is important to enforce the existing law effectively, i. e. to prosecute trespassers and to impose high fines on illegal polluters.

In addition to these regulatory policy instruments typically market-oriented instruments of water quality preservation are used, especially wastewater fees. The respective tariffs need not necessarily be linear in the sense that a constant amount of money has to be paid per cubic meter of waste water. In order to set incentives for firms to make sufficient efforts to clean their sewage before releasing it into the public sewers it is helpful to impose a waste water fee where the per-ton amount to be paid increases with the degree of contamination of the sewage discharged after treatment and with the quantity released. Additionally, certain minimum standards of waste water quality before discharge have to be defined and enforced to protect the environment, since fees alone are not sufficient to make sure that such minimum quality standards are respected.

Analogous instruments of regulatory and market-oriented environmental policy can be employed to ensure a responsible use of water from a quantitative point view: rationing of water in regions and times of extreme water shortage, restricting industries with high water consumption in favor of other, more water-efficient industries, or even shutting down water-intensive industries (the so-called "water tigers" – "shui laohu") like metallurgy, chemical industry, paper-making industry. This must be accompanied by measures like promoting the development of water-saving technologies for households and production plants, regulating the drilling of private wells in order to protect the groundwater and, most importantly, a suitable system of water fees to set economic incentives to save water for households as well as for private firms (for an extensive discussion of various economic instruments for water preservation see e. g. OECD 2009).

An important problem of all these government instruments of environmental policy is their compulsory character that provokes opposition and resistance on the side of water users, both firms and private households. These instruments work against people's preferences in the sense that they try to induce a water usage behavior that is not in accordance with their preferences. This creates incentives on the side of water users to evade or avoid these measures e. g. by drilling private wells without official permission, which then remain uncontrolled and unregulated by authorities, or by illegally tapping public water pipes, by manipulating water meters to reduce water fee payments etc. The incentives for such illegal activities are the higher the greater the discrepancy is between people's preferences on the one hand and the behavior required of them on the other. People's personal compliance costs, i. e. the psychological and financial effort required to comply with some government policy, are the higher the greater this discrepancy between preferences and expected behavior is. If government requires people to do something they would do anyway also without government intervention their personal compliance cost is zero. As soon as government wants to induce a change in people's behavior they will compare their compliance costs to the costs of non-compliance, i. e. the expected value of the costs they will face if they are caught trespassing the law. Eventually they will choose the alternative – legal or illegal – that causes the lowest (expected value of) costs to them.

In order to enforce compliance government has either to increase people's non-compliance costs by increasing the frequency of controls, the amount of fines, the number of legal proceedings against trespassers etc. or decrease their compliance costs. Since the administrative costs of enforcing compliance (monitoring costs, administering legal proceedings against trespassers etc.) are very high it seems to be attractive for government to reduce people's compliance costs by closing the gap between people's individual preferences on the one hand and social preferences, i. e. the behavior that would be socially desirable, on the other. This can be done by either changing people's preferences in the direction that is desirable from an environmental policy point of view or adjusting environmental policy as close as possible to people's preferences. The first strategy can be pursued e. g. by environmental education or by implementing social norms promoting water preservation. The second strategy requires that government assesses people's preferences for a sustainable environmental development. Both strategies will be discussed in turn in the next section.

4. Getting people involved

Environmental education as well as the orientation of environmental policy towards people's preferences for environmental changes stand for a policy that tries to get people actively involved in the implementation of a sustainable development. Such a policy is democratic and cost-saving at the same time since it minimizes the compliance enforcement costs of government like monitoring and administration costs.

Environmental education

Environmental education aims at making people aware of environmental problems and changing their attitude towards environmental issues, thereby increasing their readiness to cooperate in stopping environmental deterioration. It is a suasive policy instrument that does not induce people to act against their preferences but, instead, changes these preferences towards sustainability. It also serves for implementing social norms which induce people to comply with environmental goals in order to please other people and thereby increase their reputation. The working of environmental education can be demonstrated within the general framework of neoclassical household theory using a simple household consumption model.

Assume a household consuming two commodities x_1 and x_2, where x_1 is water and x_2 is an aggregate of all other consumption goods in the sense of a Hicksian composite commodity. Both commodities have a positive influence on the consumer's wellbeing or utility which can be represented by a neoclassical utility function

(1) $$U = u(x_1, x_2) \quad \text{with} \quad \frac{\partial u}{\partial x_n} > 0 \;\; (n = 1, 2)\,.$$

In this uneducated state the consumer is not aware of future water scarcity and of his own influence on this scarcity. If he learns in the course of environmental education about the threat of future water shortage s and about his own potential contribution to this shortage via his water consumption x_1 his preferences change and can now be represented by an (educated) utility function according to

(2) $$\hat{U} = \hat{u}\left(x_1, x_2, s(x_1)\right) \quad \text{with} \quad \frac{\partial \hat{u}}{\partial s} < 0 \;\; \text{and} \;\; \frac{\partial s}{\partial x_1} > 0\,.$$

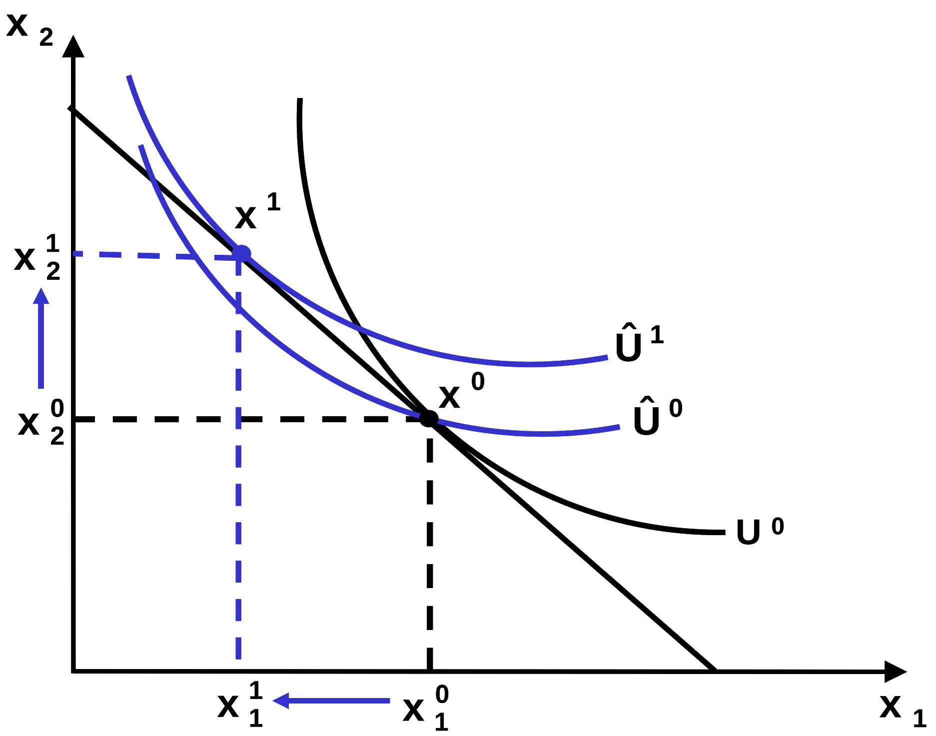
Obviously the consumer is now aware of the negative influence of his own water consumption on future water availability. Now each additional cubic meter of water does not only increase his utility as in the uneducated state but now he is also aware of the fact that this additional consumption contributes to future water shortage and this knowledge impairs his joy in water consumption. Therefore the marginal utility of water consumption is now smaller than in the uneducated state, i. e.

(3) $$\frac{d\hat{u}}{dx_1}\left(=\frac{\partial \hat{u}}{\partial x_1}+\frac{\partial \hat{u}}{\partial s}\cdot\frac{\partial s}{\partial x_1}\right) < \frac{du}{dx_1}\left(=\frac{\partial u}{\partial x_1}=\frac{\partial \hat{u}}{\partial x_1}\right)$$

That means that – other things being equal – the incentives for water consumption have decreased for the educated consumer. This can also be seen from fig. 5 where the household consumption decision with respect to water and other consumption goods is illustrated for a given budget. Before environmental education the consumption bundle x^0 is optimal for the consumer who realizes the utility level U^0. From (3) it follows that after environmental education the marginal rate of substitution between water and the other consumption goods has decreased, i. e.

$$\frac{d\hat{u}\,/\,dx_1}{d\hat{u}\,/\,dx_2}\left(x^0\right) < \frac{du\,/\,dx_1}{du\,/\,dx_2}\left(x^0\right)$$

which means that the slope of the new indifference curve is flatter in x^0 than the slope of the uneducated indifference curve. Therefore consumption bundle x^0 is not optimal anymore. The household can now increase its utility from $\hat{U}^0$ to $\hat{U}^1$ by shifting consumption from x^0 to x^1. The new consumption bundle x^1 contains less water than x^0.

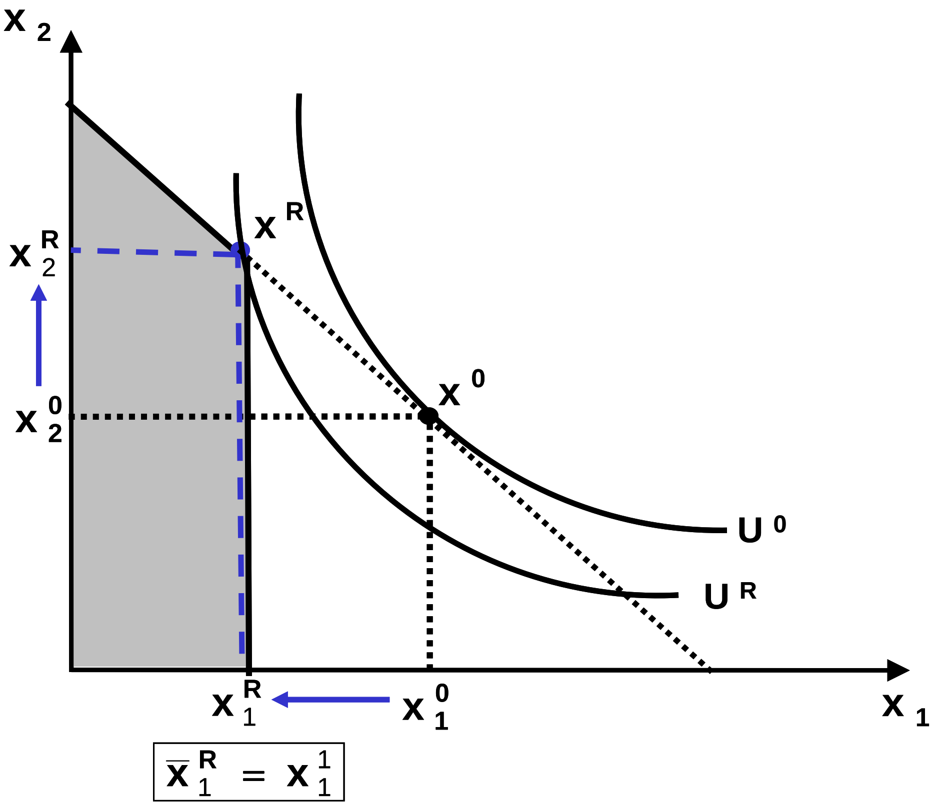


- Fig. 5: The impact of environmental education on water consumption -

This example illustrates the impact of environmental education very nicely. Without any direct government intervention in the market the household does what it is expected to do: it reduces its water consumption from x_1^0 to x_1^1. The same effect could have been reached without consumer education, i. e. with the initial, uneducated preferences, for example by water rationing or by imposing a suitable water fee.

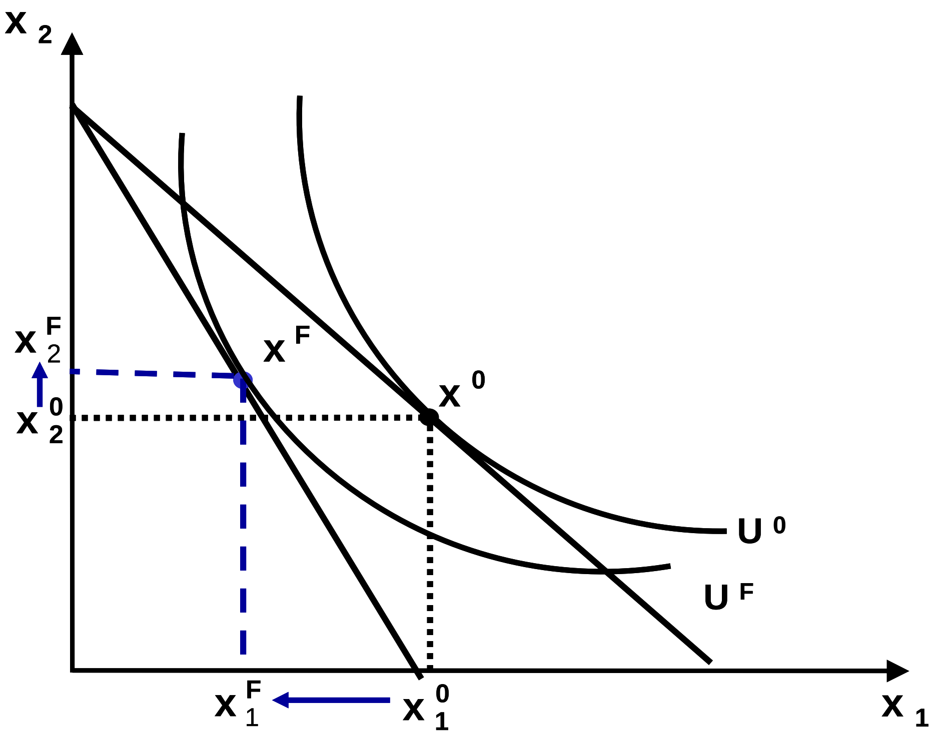
Rationing of water is common practice in many regions of China and also recommended e. g. by the Probe International Beijing Group (2008, p. 35 f.) as one of several measures for water protection. The impact of rationing on water consumption is illustrated in fig. 6 where the upper boundary of the consumer's consumption possibility set has a kink at $x_1 = x_1^R$. Here the effect of rationing on water consumption is the same as that of environmental education in fig. 5 (since the rationed water quantity x_1^R is set equal to x_1^1) but here the consumer experiences a drop in utility from U^0 to U^R. This utility loss motivates the household – at least potentially - to evade rationing e. g. by illegally drilling private wells or tapping public water pipes in order to return at least partly to its original utility level. This makes additional government action necessary to detect and prosecute this kind of hidden action in order to enforce compliance of citizens with its water saving policy. These additional measures have to be financed out of the general government budget so that either government spending on other welfare creating public projects has to be cut or additional taxes have to be imposed. In any case these compliance enforcing measures lead to welfare losses that do not exist in the case of environmental education.

Analogous compliance problems arise if a water fee is imposed. The imposition of fees or taxes is a traditional instrument of environmental policy and is regarded as the instrument of choice in the case of water saving (see e. g. Tietenberg (2006, p. 210 ff.), or OECD 2009). The Probe International Beijing Group (2008, p. 33 ff.) recommends even full-cost pricing for tap water in Beijing though this would mean a radical change as compared to the very low water prices that are charged now from Beijing citizens.



- Fig. 6: The impact of rationing on water consumption -

Fig. 7 shows the impact of a water fee on water consumption. The budget line becomes steeper with the new water price being (p_1 + fee) instead of p_1. In fig. 7 the amount of the fee is chosen such that it yields the same outcome as the environmental education regarding water consumption, i. e. $x_1^F = x_1^1$. In spite of the fact that in this case the household chooses "voluntarily" the same water quantity as in the case of environmental education this choice implies a utility loss (U^0 - U^F) as compared to the initial situation since the choice of x^F instead of x^1 results from changed prices and not from a change in preferences. Therefore, like in the case of rationing the household may find it attractive to evade the fee by illegal actions so that additional government measures are necessary to prevent such actions. Financing these additional measures out of the public budget causes further welfare losses like in the case of water rationing. Additionally, a water fee like a distortionary tax causes an excess burden, i. e. a welfare loss in excess of the utility loss that would be caused if the amount of the fee were charged in a lump-sum fashion.[2]



- Fig. 7: The impact of a water fee -

From these considerations it follows that from a welfare economic perspective environmental education is to be preferred to compulsive environmental instruments like rationing or the imposition of fees or taxes – as long as these instruments lead to the same ecological results as the other instruments. This is, of course, the problem with environmental education. The impact of environmental education on people's preferences and on their consumption decisions is not clear from the beginning and, therefore, cannot be planned in advance. If it is important to reach a specific quantitative ecological goal within a specific span of time a compulsory instrument like rationing or other instruments of regulatory policy are to be preferred. If the desired ecological goal is less precisely specified economic instruments like fees, taxes or subsidies are to be preferred since they are more efficient from an economic point of view than rationing (see e. g. Stavins 2003). The success of environmental education to reach a certain ecological goal is more or less uncertain. Therefore, environmental

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[2] For the concept of excess burden see e. g. Slemrod 1990.

education is ideal an instrument to accompany more precise instruments like rationing or taxation in order to reduce resistance to these instruments and prevent non-compliance.

Preference-adjusted water protection policy

As explained above it is useful to adjust the design of compulsory environmental policy instruments to people's preferences in order to minimize compliance enforcement costs. In the case of water preservation water fees are a well-accepted and useful instrument to induce people to use water sparingly. Especially in China water fees are much too low to serve this purpose, often no water fees are charged at all (cf. World Bank 2007, p. 42, or Probe International Beijing Group 2008, p. 33). Therefore, it is generally recommended to use water fees to ensure a sparing use of water (see e. g. Wang 2005, World Bank 2007, Probe International Beijing Group (2008, p. 34), OECD 2009). Also in Article 48 of the Water Law of the People's Republic of China from 2002 the collection of water fees is encouraged, though small quantities for domestic uses are exempted here. It is clear that a sudden increase of water fees from zero to a full-cost pricing level as recommended e. g. by the Probe International Beijing Group (2008, p. 34) will provoke opposition and all kinds of hidden action on the side of the water users to evade this fee. In order to reduce compliance enforcement costs of the government it is recommendable to choose water fees not too different from people's preferences, i. e. from their willingness to pay (WTP) to ensure future water availability.

The technique at hand for the assessment of people's WTP for environmental values like sustainable water supply is the Contingent Valuation Method (CVM) though other methods like Attribute-Based Choice Modelling, i. e. certain versions of Choice Experiments, might also be helpful (see e. g. Adamowicz et al., 1998; Louviere et al., 2000; OECD, 2002). The CVM is a survey-based method in which a random sample of the households affected by a certain government project or policy (like e. g. water preservation policy) is interviewed in order to assess their willingness to pay (WTP) for this project, i. e. their willingness to contribute to its realization. In such an interview respondents are first presented a scenario describing the project to be valued (e. g. ensuring a sustainable water supply for the future instead of following a business-as-usual strategy) and then, among other things, they are asked their maximum WTP to make this change happen. The individually stated WTP amounts are then aggregated in order to derive the overall social value of the project in question. In addition, information on the socio-demographic and attitudinal characteristics of the survey respondents is elicited which allows to estimate the determinants of WTP, i. e. the relation between the WTP stated by a household and its socio-demographic and attitudinal characteristics (see e. g. Ahlheim et al. 2006 and 2009 or Ahlheim / Frör 2003). This makes it possible to derive some kind of "socio-demographic profile" of the different household groups according to their WTP for a sustainable water supply.

The CVM is a so-called direct assessment method which can be used to assess use values as well as nonuse values accruing from an environmental program. A comprehensive water protection program would comprise measures for protecting surface and ground water against pollution and measures to ensure water availability for the future. Examples of possible use values of such a policy are the prevention of threats to people's health caused by polluted tap water as well as by contaminated food (since the polluted surface water is typically also used for irrigation in agriculture) and the avoidance of future water shortage for people and also for agricultural production. Nonuse values accruing from such a program are e. g. aesthetic values which arise from saving riverbeds and wetlands from drying up or from the preservation of ecosystems in these areas together with the respective ecosystem functions and ecosystem services. These potential benefits arising from a water preservation program have to be described to respondents of a CVM survey and then their WTP for the realization of such a program has to be elicited together with their socio-demographic characteristics and opinions and attitudes towards environmental issues.

From such a CVM survey it can be seen how much people appreciate a sustainable water preservation policy, what their personal willingness to contribute to such a policy is, what financial sacrifices they are ready to make and what their personal attitudes towards sustainability of water provision are. From this information it can be deduced how much support for a sustainable water policy, e. g. the imposition or increase of a water fee, can be expected from the population. This is a good indication for the degree of compliance or non-compliance that has to be taken into account when designing a new water policy entailing water fees or requiring other sacrifices of water consumers. Therefore, CVM studies are an effective instrument for the assessment of new policies, giving a good impression of the compliance enforcement costs to be expected.

5. An empirical example

In this section some preliminary results from a CVM study conducted in Xishuangbanna are presented in order to convey a rough idea of the information that can be expected from such a study. The CVM survey in question was conducted in the context of the interdisciplinary Chinese-German cooperation project *"Rural development by land use diversification: stakeholder based strategies and integrative technologies for agricultural landscapes in mountainous Southwest China"* (short form: "Living Landscapes China" - LILAC). Six Chinese universities and scientific institutions (Xishuangbanna Trop. Bot. Garden, China Agricultural University, Nanjing Agriculture University, Yunnan Agricultural University, Yunnan Academy of Social Sciences, Chinese Academy of Sciences) and six German universities (University of Hohenheim, University of Passau, University of Kassel, Humboldt University Berlin, University of Giessen, University of Hannover) are working together in this project (for details see http://www.troz.uni-hohenheim.de/research/lilac).

In the economic subproject ("Employing direct and participatory valuation methods for supporting allocative decisions in environmental policy", conducted by Ahlheim, M., Börger, T., Frör, O., Jin, L.,) of LILAC a CVM study was conducted with 600 completed face-to-face interviews. Objectives of that study were (1) to highlight the awareness of people living in

Jinghong of the threat to biodiversity emanating from the expanding rubber plantations in Xishuangbanna, (2) to assess their WTP for a potential reconversion of rubber plantations into forest and (3) to assess the determinants of people's WTP for such a biodiversity preservation project in order to get an idea of its distributional effects ("Which groups of the population will benefit most, which will benefit least?").

The preliminary results obtained from this study showed e. g. that

- younger people do not mind to attach a monetary value (WTP) to environmental goods while older people do;

- higher educated and better earning people accept more easily the idea that also private households have to pay for environmental improvements while less educated low-income households think they are entitled to enjoy a sound environment without any personal sacrifices;

- older people more than younger people tend to assume an anthropocentric perspective towards nature, i. e. they hold that nature has to serve man and not the other way round.; for them nature has no (intrinsic) value in itself.

In addition to these results regarding people's attitudes towards nature and environment the study yielded the following determinants of WTP for environmental improvements (I this case biodiversity preservation): it showed that WTP for biodiversity preservation in Xishuangbanna is

- negatively correlated with age,

- negatively correlated with the number of children living in a household,

- positively correlated with the level of education,

- positively correlated with life satisfaction items like satisfaction with job or satisfaction with income.

These results though they are only preliminary and refer to a specific environmental program (biodiversity preservation in Xishuangbanna) give an indication of Chinese people's attitudes towards environmental improvements and of the distribution of their willingness to contribute personally to such a development. Analogous studies will be conducted with respect to people's willingness to support a more sustainable water preservation policy in different regions of China.

6. Concluding remarks

In this paper it is postulated that the design of environmental policy should not neglect the problem of compliance of people with such a policy and the costs to enforce compliance if government policy is in contrast to people's preferences. The farer environmental policy deviates from people's preferences the stronger are the incentives for people to evade this policy. China faces enormous problems regarding the quality and the availability of water in the future. In the scientific and political discussion on sustainable water policy for China typically regulatory measures (rationing) and higher water fees (full-cost pricing) are recommended. It is argued here that such measures create strong incentives for the population concerned to evade these measures e. g. by illegal tapping of public water pipes, by manipulating water meters or by drilling illegal wells of their own. In order to prevent such hidden and illegal action government has to use scarce public means to detect and prosecute such behavior. The monitoring and administration costs arising from these measures are enormous. It was shown that the incentives for illegal action of citizens can be reduced considerably by either "adjusting" people's preferences to the environmental necessities or adjusting environmental policy to people's preferences or both. Environmental education helps to change people's preferences towards a more environmentally friendly behavior so that an enforced change of behavior is less necessary and the compliance enforcement costs of government are lower. If government chooses the other alternative, i. e. adjusting its water preservation policy according to people's preferences, it has to assess these preferences first (i. e. people's attitudes towards a sustainable water preservation policy and their willingness to contribute to such a policy). This information can be gained by Contingent Valuation surveys evaluating the respective policy measures. Preliminary results from an empirical study in Xishuangbanna showed that especially well-educated younger people in China with higher incomes are willing to contribute personally to a more sustainable future of their country.

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