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## **Social Sciences and Economics in Sustainable Water Management**

To get a deeper understanding of the problems concerning "Sustainable Water Management" it is necessary to take into consideration not only the hydrological, technical, biological and chemical aspects but the political and economic ones as well. Therefore, we have to understand water, especially fresh water, not only as an element which can be analyzed from an hydrological or hydraulic perspective but as an economic good which has to be produced and distributed. After consumption it has to be collected as waste water, reclaimed and perhaps reused. That means even waste water can be treated as an economic good.

### **Water and the theory of goods**

Economic goods can be offered by private companies or by public authorities. In the first case water is a private, in the second case a public good. The price for water (and for reclaimed waste water) depends not only on the relation of supply and demand but has to reflect the necessary costs. In case of water as a private good the price has not only to cover the costs, but a profit for the company has to be added. In case of water as public good the price can be below the costs, because the difference is covered by taxes. In this case the price for water is a political price. That means, water becomes a political good depending on many aspects (to create mass loyalty for the government for example), which have nothing to do with the water sector in a narrow sense.

Other problems to be regarded, especially in a situation of water shortage, are the possible distribution conflicts between agriculture, industry and households as major users of water. Therefore some kind of regulation (water governance) is

necessary to solve distribution conflicts. This can be done by the market, if water is treated as a private good. In this case the price for water works like an instrument to resolve distribution conflicts and to give incentives to save water. Or it can be done by a water authority, if water is treated as a public good. In this case a whole set of regulations, control mechanisms and sanctions in case of violating the regulations is necessary.

To clarify the mentioned problems a brief introduction into the theory of goods is helpful<sup>1</sup>. The different types of goods are defined by the criteria "exclusion" and "rivalry". Exclusion means that somebody can be excluded from the use/consumption of a good or service. Rivalry means that the amount of a certain good or service is limited. Its consumption by somebody means that it is no more available for somebody else. If the available amount is not limited anybody can use a good or service as often as he likes without doing harm to somebody else. The combination of the two variants of both criteria is shown in a matrix.

		Rivalry	
		yes	no
Exclusion	yes	(1) private good	(2) club good
	no	(3) common good	(4) public good

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<sup>1</sup> See R. Corner/T. Sandler, *The Theory of Externalities, Public Goods, and Club Goods*. Cambridge: Cambridge UP 1986.

If rivalry and exclusion is given we have the case of a "private good" (1). If you have not the money to pay for the good or the service you are excluded from the consumption. The good consumed by one customer can no more be consumed by another one. Just the opposite case is given if nobody can be excluded from the consumption and there is no rivalry between the consumers. In this case we speak of a "public good" (4). A prominent example for a public good is the traffic light. No car driver can be excluded to use the service of a traffic light. The use of the first driver does not harm the use of the next one. The consumption of the first type of good, produced by a private company, is regulated by the market. The fourth type of good is produced by the state and its consumption is regulated by the state as well.

But there are two exceptions. If somebody can be excluded but there is no rivalry we speak of a "club good" (2). To use the facilities of a club you have to be a member. Nonmembers are excluded. You can use the facilities of the club (the sauna for example) as often as you like without doing harm to another member. A club good is offered by an association and regulated by its statute.

The opposite case to a club good - rivalry yes, but exclusion no - is called "common good" (3). No farmer of a valley can be excluded from using the common pasture or the water of a creek. But the trout caught by one fisherman (or the grass eaten by one head of cattle) is no more available for another fisherman or farmer. A common good is a free gift of nature. Its consumption is regulated by tradition to avoid overuse, which occurs if no regulation in using common goods is established.

Examples for **water** as a private good are bottled water sold in the supermarket or the water seller who delivers water to a village by a tanker. If you have a waterwork, run by a public water authority, and everybody is connected to the water pipe, you have the case of water as a public good, even if the individual consumption of water is counted by a water meter. A well in the desert, belonging to the area of a tribe, is an example of water as a club good. Herdsmen of other tribes are not allowed to water their cattle and can be hindered to use the well even by force. If farmers take water to irrigate their fields out of a river you have the case of water as a common good. If the water left for the farmers of the next village downstream is not sufficient to irrigate their fields as well, you have a classical distribution conflict as result of overusing a common good and demand for regulation to respect the interests of the downstream villages.

Even in the case of waste water all four types of goods are possible. A private company or a public company can run a waste water treatment plant. Producers of waste water have to pay for the waste water to be reclaimed, depending on the amount of fresh water they have consumed, or the waste water treatment plant is financed by taxes. In the case of waste water as a club good you have a public-private partnership like the "Water Association" in Braunschweig. Only the members can (or have to) use the reclaimed waste water for irrigation. In the case of waste water as a common good you dispose waste water unreclaimed into a river, a lake or the sea.

In any of the four cases of the typology you need some kind of regulation to avoid overuse or pollution of water and to settle conflicts as result of overconsumption or pollution. From a political as well as from an economic perspective regulation has to be the core of sustainable water management.

Based on the criteria mentioned you can add further variables to the typology. In the first case water in terms of water resources and water services is the property of an individual or a company, very often connected to the ownership of land. In the fourth case it is property of the state, in the second case of a group (village, tribe) and in the fourth case there is free access for anybody. The necessary investments to produce and to distribute fresh water and to collect and reclaim waste water are made by a private water company, by a public water authority, by members of a village (or tribe) or by nobody. Regulated is the consumption via the market (prices), by laws or ordinances, by statutes or by conventions<sup>2</sup>.

If you look for the distribution of water worldwide by type of good you see that not only saltwater belongs to the category 3 (common good) but most of the fresh water resources as well. The typology shows also that water as a common good is the most difficult case to handle to avoid overconsumption, to solve distribution conflicts and to follow the approach of sustainable water management. The problems are even growing if water is an international or transnational common good because there is no strong corresponding international authority to regulate the access. Transboundary river basins, lakes or aquifers are examples for international common goods. The high sea or the ice shields at the north- and southpole are examples for transnational common goods.

### **The Tragedy of the Commons**

Behind the use of water as a common good (for irrigation, shipping, fishery, energy production, garbage dumping, deep

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<sup>2</sup> For the latter case see Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Actions*, New York: Cambridge UP 1990.

sea mining) lurks a serious and very difficult to handle problem. Related to common goods the classical (liberal) economic theory makes no sense<sup>3</sup>. The classical theory says that if everybody is looking for his personal benefit the result is the common benefit. If you deal with common goods just the opposite is the case. If each fisherman catches as much fish as he can to enlarge his individual profit, in the end there is no more fish to catch for anybody. If each consumer of fresh water disposes unreclaimed waste water into a river to save money, necessary to reclaim the waste water, in the end the river is so polluted that its water is no more useful for anybody and anything - as drinking water, as water for irrigation or as living space for animals.

Therefore - the unregulated access to a common good leads to the "Tragedy of the Commons"<sup>4</sup>. The tragedy threatens if the use of a natural resource like a river, lake or aquifer, to which a lot of people or countries have access, is not regulated. If there is no regulation it will be depleted or polluted very soon. Every user, looking for his personal benefit, has to decide: How much water can I take, how much waste water can I dispose? If everybody contains himself, the common resource can be used in a sustainable way and everybody keeps a benefit. The problem in not containing himself is the result of distrust in the behavior of others. If I contain myself, but others do not, the system will collapse although I did not have even the shortterm individual benefit as the others had. Therefore every user is in a dilemma. If he contains himself not and looks for his benefit he enforces the tragedy of the

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<sup>3</sup> See Scott H. Gordon, *The Economic Theory of Common Property Resource: The Fishery*. In: *Journal of Political Economy*, 62. 1954, 1. pp. 24-42.

<sup>4</sup> Garret Hardin, *The Tragedy of the Commons*. In: *Science* 162. 1968, No. 3859, pp. 1243-1248; Garret Hardin/J. Baden (eds.), *Managing the Commons*. San Francisco: Freeman 1997; Elinor Ostrom/Thomas Dietz/Nives Dolsak/Paul C. Stern/Susan Stonich/Elke U. Weber (eds.), *The Drama of the Commons*. Washington DC: National Academy Press 2002.

commons. If he contains himself to avoid the tragedy he is losing his individual benefit.

There are several economic, psychological and political arguments, why users do not behave sustainable:<sup>5</sup>

1. Because there is, as Gordon Scott has shown, a difference between maximizing the economic gain and maximizing the sustainable gain in using common goods like water. Every user considers only his individual benefit, but regards not the effects of his behavior to others.

2. Because users follow their individual rationality. The advantage of using a common good belongs to the individual. The disadvantage of overusing or polluting it is spread to many. As long as the individual advantage is bigger than the individual share of the collective disadvantage, it is rational to act in that way. The paradox result is that the sum of the individual rational behavior ends in the common loss instead in the common benefit.

3. Because of the constellation modeled by the "prisoners dilemma".<sup>6</sup> Cooperation with better results for all comes not into existence because of the mistrust in the behavior of others.

4. Because of the freerider argument. The negative effect of my behavior is that low in comparison to the high number of water users that it rarely counts. If I would change my behavior the positive effect for the community would not be countable, but my personal disadvantage would be very high. The freerider argument becomes stronger the larger the group involved is. In

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<sup>5</sup> R.M. Dawes, The Commons Dilemma: An N-Person Mixed-motive Game with a Dominant Strategy for Defection. In: ORI Research Bulletin 13.1973,1. pp. 1-12.

<sup>6</sup> Rapoport, Anatol/Chammah, Albert M., Prisoner's Dilemma: A Study in Conflict and Cooperation. Ann Arbor: University of Michigan Press 1965.

small groups the individual behavior is controlled by the observation of the other members.<sup>7</sup>

To avoid the tragedy of the commons it is recommended to transform a common good into a private good. In this case the costs and benefits of sustainable or unsustainable behavior become clear for everybody. The enclosure movement in England since the eighteenth century is the classical example for this approach. The consequence was that the lower end of the rural population was no more able to find a living in the countryside and was forced to migrate to the city or to emigrate to overseas countries. The other possibility, strongly recommended by Hardin, is to transform a common good into a public good. In this case the state is responsible to regulate the access, to look for sustainability and to sanction unsustainable behavior. But the vanishing of the Lake Aral in the former Soviet Union is an impressive negative example that this alternative can also lead to a tragedy.<sup>8</sup> Elinor Ostrom has shown by her investigations that at least small communities are able to treat common goods as club goods and to find regulations for sustainable behavior.

To transform a common good into a private, a public or a club good and to regulate the access to reach sustainability on the local or national level is possible as many examples show even in the case of water. Especially the World Bank recommends private sector participation in the water supply and even the waste water treatment<sup>9</sup>. But what happens if you deal with an

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<sup>7</sup> For this argument see Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Goods*. Cambridge, Mass.: Harvard University Press 1965.

<sup>8</sup> Philip Micklin, *The Aral Sea Crisis and Its Future: An Assessment in 2006*. In: *Eurasian Geography and Economics* No. 5, 2006. pp. 546-567.

<sup>9</sup> Daniel Rivera, *Private Sector Participation in the Water Supply and Waste Water Sector: Lessons from Six Development Countries*. Washington D.C.: World Bank 1996.



international common good like a transnational river basin or a transnational common good like the high sea?<sup>10</sup> The transformation of a river basin into an international private, public or club good is not possible. The only approach, which offers solutions, is to come to international cooperation. The existing examples of water governance of international river basins show how difficult it is to find compromises between the opposite interests of the riparian countries<sup>11</sup>.

### **Water governance and conflict resolution**

All proposed approaches to overcome water shortage, to avoid pollution or to come to a sustainable water management have in common that the understanding of water as a common good, as a free gift of nature and related aspects of water governance are touched. If you look for technical solutions to mobilize additional water, maybe a low tech approach like rainwater harvesting<sup>12</sup> or a high tech approach like water mining from aquifers or desalination of water, you have to ask and answer several questions: Who is responsible? Who pays for it? Are the necessary investments financed by private means or by taxes? What is the price for water? Is the population at all prepared to understand water as an economic good which can be traded and which allows somebody to make profit? Or is there a deep rooted understanding of water as human right, a free gift of nature or at least of water as a political good? Does this mean that the state has to be responsible under any

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<sup>10</sup> Olli Varis/Cecilia Tordajada/Asit K. Biswas (eds.), Management of Transboundary Rivers and Lakes. Berlin: Springer 2008.

<sup>11</sup> In the case of the Nile see John Waterbury, Hydropolitics of the Nile Valley. Syracuse: Syracuse UP 1979; Mina Michel Samaan: The Win-Win-Win-Scenario in the Blue Nile's Hyropolitical Game: Application on the Grand Ethiopian Renaissance Dam. Braunschweig: Institute of Social Sciences 2014. Forschungsberichte aus dem Institut für Sozialwissenschaften Nr. 113.

<sup>12</sup> Clement Dorm Adzobu, Rainwater Harvesting in the Coastal Savannah Region of Ghana. Braunschweig: Institute of Social Sciences 2012. Forschungsberichte aus dem Institut für Sozialwissenschaften Nr. 104.

circumstances? And if so, is the state allowed to demand water prices which cover the costs?

The same problems come up, perhaps even stronger, if you follow an ecological approach. Waste water treatment and reuse of treated waste water under the condition of water as a common good is even more difficult to handle, because you need an understanding of waste water as an economic good. The price to reclaim waste water can, depending on the grade of pollution, be higher than to produce fresh water. From an economic point of view it makes more sense to mobilize additional water by technical means than to reclaim and reuse reclaimed waste water, which makes more sense from an ecological perspective. In so far you have a classical dilemma between an ecological and an economic approach, which is not easy to solve especially in poor countries. The opposition of water users to pay for waste water, if treated or not, could be higher than to pay for the mobilization of additional fresh water. Therefore for the government it is easier to follow the economic approach although the ecological situation becomes worse.

But even pure even economic approaches demand changes of behavior, environmental education, an understanding of water as an economic good, changes in the international division of labor, respected consequences for the trade policy, etc. A prominent pure economic example is the water footprint approach<sup>13</sup>. To follow this approach means to take into consideration what amount of water is necessary to produce and offer a certain unit of a good or service. To reduce the consumption of water in arid zones demands the establishment

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<sup>13</sup> Tony Allan, *Virtual Water - Tackling the Threat to our Planet's Most Precious Resource*. London: Tauris 2011.

of an international division of labor by comparative advantages in producing water intensive goods or services. A country with water shortage can save water by importing water intensive products from countries with a surplus of water instead of producing them. This is called virtual water trade. But - if you follow the water footprint approach, if you follow the approach, of saving water by repairing demolished pipes, by multiple use of water, by drip irrigation or just by rising water prices and hoping that people will react, you are confronted always with the same mixture of political, social, economic and even cultural problems.

In any situation of rivalry between water users you have distribution conflicts. These can occur between farmers, villages, tribes, economic sectors, regions, riparian states or man and nature. Industrialization, growing population, rising income, "development" in a broader sense always means that a growing part of the water resources available are consumed by industry and households instead of agriculture, that the water consumption per capita is rising and especially that a growing part of the water available becomes polluted. Any kind of development means that more and more water is needed, that somebody has to be responsible to produce additional water, to reclaim waste water and to regulate the distribution of fresh water and the collection of waste water. Who is responsible for these regulations, is always a political question, deeply rooted in the political culture and history, depending on the political system of the respective country and on the variable if you have an agriculture this rainfall or artificial irrigation.<sup>14</sup>

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<sup>14</sup> Francesca Bray, *The Rice Economy: Technology and Development in Asian Society*. Los Angeles: University of California Press 1986.

Social and even cultural problems come up if you follow the ecological approach to reuse reclaimed waste water. One major problem is the price. In a society where water is understood as a common good, as a free gift of nature, it is hard to believe that people are prepared to understand waste water as an economic good and to pay for reclaimed waste water a price which is higher than for fresh water. Besides the problem of economic acceptance you have the problem that people hesitate to use reclaimed waste water by hygienic or religious reasons. So you have to find out before starting any respective investments very carefully, under which conditions and for what purposes reclaimed waste water is accepted by the population. If not for drinking, cooking or washing maybe for irrigation the garden, but not to produce vegetables, for toilet flush or for car washing. To change behavior demands not only information and education but above all a lot of time. Field studies show that just the opposite can be the case. Farmers which have free access to unreclaimed waste water like to use it for irrigation because of the nutrients waste water contains. Waste water as manure is like a free gift of nature (common good) for them. Therefore they can be in strong opposition against reclamation because they not only have to pay for reclaimed waste water, but even have to pay for losing something, namely the nutrients, unreclaimed waste water contains.

International disputes, even serious international military conflicts, can come up between countries which are riparians of transboundary river basins<sup>15</sup> in arid or desert zones. The river Jordan and the conflict between Israel, Jordan, Syria and Palestine, the river Nile and the conflict between Egypt,

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<sup>15</sup> All relevant informations and data are presented by the University of Oregon in the Transboundary Freshwater Dispute Database under: [www.transboundarywaters.orst.edu](http://www.transboundarywaters.orst.edu); see further Ashok Swain, Managing Water Conflict: Asia, Africa, and the Middle East. London: Routledge 2004.

Sudan and Ethiopia, the Colorado river and the conflict between the US and Mexico, the lake Aral and the conflict between the former central asian soviet republics show that in arid zones water is essential for irrigation in agriculture to feed a growing population. Several international conflicts, the Near East Conflict is the most prominent example, can be understood as water conflicts<sup>16</sup>. Therefore, to overcome water shortage, to settle distribution conflicts between riparian states, to implement the concept of sustainable water management on an international level an integrated, interdisciplinary and transnational research approach is necessary.

### **The water footprint**

Let us take the mentioned water footprint as an example of demand for further research. The water footprint of a product or service means not only the amount of water necessary to produce a certain unit, but also to transport it to the consumers. To identify the water footprint many open questions have to be answered. Where is the product produced? How is it produced? Where and how is it processed? How and where is it consumed? How is it transported to the consumers? What happens with the waste? What happens with the waste water? What is the water footprint of the sideline activities like packing, transporting, storing, cooling? What is the water footprint in the service sector as such - for example in the tourism sector? How much water is used per day and tourist in a large hotel compound in a Mediterranean country for cooking, shower, toilet, washing, swimming pools, irrigation of gardens, sport grounds, golf resorts etc.? How much water is necessary to produce the additional food for the tourists? Does it make

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<sup>16</sup> J. Anthony Allen (ed.), *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. London: Tauris 1996.

really sense from the perspective of sustainable water management to build up a huge tourist industry in countries like Egypt (Red Sea) or Jordan (Dead Sea)?

If you come to clear findings of the aspects mentioned you have to compare the water footprint of similar products and services between countries to find out the respective comparative advantage in terms of water. In the next step you have to establish an international division of labor under the consideration of the amount of water involved to save water by trade in virtual water<sup>17</sup>. This division of labour follows not a purely Ricardian cost saving approach but is oriented to the availability of water or the strategies possible to produce additional fresh water. At least in theory it could be sustainable that the energy intensive desalinization of sea water combined with drip irrigation to produce fruits or vegetables for export makes sense in a country like Israel with high technological competence, while in neighboring Jordan or Palestine it makes more sense just to cover the fields with plastic foils to reduce evaporation.

But - to come to an international division of labor, modeled by the water footprint approach, it is necessary to change the trade policy of the countries involved. The expected target to reduce the consumption of water worldwide demands free trade in agricultural products. But agriculture, especially in many arid countries, is the most protected economic sector by tariffs, subsidies and nontariff barriers. In poor and arid countries it is hard to identify alternative occupations for the rural population if they have to give up their agriculture to follow the water footprint approach. Thus, again social and

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<sup>17</sup> Ashok K. Chapagain, *Globalisation of Water: Opportunities and Threats of Virtual Water Trade*. London: Taylor & Francis 2006.

political problems are touched. The latest negotiations of the World Trade Organization (Doha Round) show how difficult it is to come to a free trade regime for agricultural products. In theory the water footprint approach seems to be an elegant solution to save water and to follow the sustainable water management approach on a world scale, but in practice it is hard to believe that this comes into existence in the near future.

### **What had be done during the five years of EXCEED I?**

During the five years of EXCEED I it was not possible to undertake research on all the topics mentioned. Nevertheless the number of field trips, the exchanges of bachelor-, master- and PhD-students, the guest professors invited and the summer schools held by the Institute of Social Sciences (ISS) of the TU Braunschweig show that it was possible to select a number of relevant problems, undertake research, organize respective lectures, seminars, workshops and conferences in Braunschweig as well as in cooperation with the partner institutions abroad. The following list documents the activities of the ISS during the last five years:

#### **I Field studies in partner countries**

1. Karsten Breßler, The Watersector of Jordan: How Does the Water Strategy of Jordan Fits to the Integrated Water Ressources Management Approach of the Global Water Partnership? (2012)
2. Matthias Berthold, The Jordan Basin as a Common Good (2012)
3. Stefanie Augustine, The Impact of Climate Change on Irrigated Agriculture in Vietnam (2013)

4. Moritz Böttcher, *The Impact of the World Bank on the Water Politics in Ghana* (2013)
5. Lena Dieckmann, *The "Right to Water" and Water problems in Ghana* (2013)
6. Sören Köpke, *Climatic Change, Water Scarcity and Conflict in Sri Lanka* (2013)
7. Jonas Bazan, *Improvement through Integration? A Case Study of Guadalajara's Water Management* (2014)
8. Sina Breitevischer, *Problems of Water Supply and Waste Water Disposal of Rio Atemajac and the Local Self-Organization of the Inhabitants of Guadalajara* (2014)
9. Imke Dette, *Water Footprint in the Tourism Sector of Antalya* (2014)
10. Andreas Ryll, *Acceptance of Waste Water Reuse in the Tourism Sector of Antalya* (2014)
11. Cara Transfeld, *Sustainable and Safe Water Supply in Rural Areas of Ghana under the Gender Perspective* (2014)

## **II Bachelor- and Master Theses Written in Braunschweig without Field Trip**

1. Khaled Abusamhadaneh, *Transboundary Water Management in the Western Part of Jordan: Challenges and Solutions* (2012)
2. Andreas Mücke, *The Nile Basin Initiative as a Case for Cooperation in a Transboundary River Basin* (2012)
3. Cara Transfeld, *Water Supply in the Countryside of Ghana under a Gender Perspective* (2013)
4. Marvin Zimbelmann, *The Role of the Nile Basin Initiative (NBI) and the Conflict over the Nile Water* (2014)



### **III PHD Theses**

1. Sören Köpke, *A Political Ecology of Climate Change, Drought-famine and Social Conflict* (2013 ff.)
2. Mina Saamann, *Transboundary Water Governance in the Eastern Nile* (2014-2016)

### **IV Research Papers/Documentation of summer schools**

1. Henning Thobaben, *The Water Conflict in the Jordan Basin: Cooperation in the Water sector as a Contribution to Settle the Near East Conflict?* (2005)
2. Clement Dorm-Adzobu, *Rainwater Harvesting in the Coastal Savannah Region of Ghana* (2012)
3. Norbert Dichtl/Ulrich Menzel (eds.), *Climate Change and Global Water Problems*. (2013)
4. Ulrich Menzel (ed.), *Water and International Relations*. (2013)
5. Nguyen Minh Vuong, *Climate Change and Water Scarcity in Agriculture: Rainwater Harvesting in Semi-Arid Coastal Area of Vietnam* (2013)
6. Mina Samaan, *The Win-Win-Win Scenario in the Blue Nile's Hydropolitical Game: Application on the Grand Ethiopian Renaissance Dam*. (2014)

### **V Summerschools**

1. *Water and International Relations* (2011)
2. *Climate Change and Global Water Problems (with the Institute of Sanitary and Environmental Engineering)* (2012)

### **VI Lectures and Seminars**

1. Clement Dorm-Adzobu  
*Sustainable Water Resources Management* (SS 2012)

From the Ground Up: Interface between Traditional Modern Systems of Water Resources Management in Ghana (WS 2012/13)

2. Sören Köpke

Political Ecology of Climate Change, Resource Scarcity and Conflict (2014)

Loss and Damages: A New Mechanism in Global Climate Policy (2014)

3. Cecilia Lezama

Water, Environment and Sustainability in Development Plans (SS 2014)

The Hydraulic Perspective in Water Management: Case Studies of Social and Environmental Costs (SS 2014)

Sustainable Cities: Water Supply Problems in Urban Planning (WS 2014/15)

Social Conflicts for Water and Environmental Movements (WS 2014/15)

4. Ulrich Menzel

The Political Economy of the Water Sector (WS 2012/13, WS 2013/14)

Water from the Perspective of Development Politics (WS 2013/14)

**VII Lectures**

1. Sören Köpke

Political Ecology of Irrigation in Agriculture (2013)

Climate Change and Social Conflict (2013)

Agrofuels, Conflicts over Land Rights and Food Security (2014)

2. Ulrich Menzel

The Social Science Perspective in Curricula on Sustainable Water Management (2009)

The Transboundary Freshwater Dispute Database (2009, 2011)

Water Politics (2011)

Activity Report in the Social Sciences (2011)

Social Aspects of Global Warming (2011)

Transboundary Conflict of Riverbasins (2012)

Water and Institutions (2012)

The Tragedy of the Commons (2012)

**VIII Panel Discussions**

1. Water for all? Between Economic Good and Human Right (2012)

2. Water: Resource and Topic for Conflict (2012)