The final version of this article has been published as Lodemann, Justus; Ziegler, Rafael; Varga, Pavol (2010): The New Water Paradigm. Human Capabilities and Strong Sustainability. In: International Journal of Water 5 (4), 429–441.

The New Water Paradigm, human capabilities and strong sustainability

Justus Lodemann* and Rafael Ziegler
Socio-ecological Research Group GETIDOS,
University of Greifswald,
Soldmannstr. 23, 17489 Greifswald, Germany
E-mail: justus.lodemann@uni-greifswald.de
E-mail: rziegler@uni-greifswald.de
*Corresponding author

Pavol Varga
NGO People and Water,
Čermel´ská cesta 24,
040 01 Košice, Slovak Republic
E-mail: varga@ludiaavoda.sk

Abstract:
According to the New Water Paradigm (NWP) developed by Michal Kravčík, Jan Pokorný, Juraj Kohutiar, Martin Kováč, and Eugen Tóth (2008) the collection and retention of rain water in rural and urban areas can strengthen the small water cycle, cool cities, reduce extreme weather events, and mitigate climate change. This paper examines the relation of the NWP to the capabilities approach and theory of strong sustainability. The first section introduces the concepts of strong versus weak sustainability, natural capital, and ecosystem services of water. Section two sketches the old water paradigm (OWP) contrasting this with ecological claims at the core of the NWP. The third section asks whether the NWP meets the criterion of strong sustainability in water management. The analysis suggests that 1) the NWP is likely to increase the capacity of ecosystems to deal with stress, a key objective of sustainability; and 2) the NWP can promote social goals associated with strong sustainability through meeting basic capabilities. A qualified statement is offered because effective implementation of sustainability using the NWP will depend on political commitment and social participation.

Keywords:
New Water Paradigm, small water cycle, strong sustainability, capabilities approach, ecosystem services, resilience, hydraulic mission, climate.

Biographical notes: Justus Lodemann, a former consultant, is now a member of the Social-Ecological Research Group GETIDOS at the University of Greifswald. He is researching the ecological impacts of social entrepreneurs in the water sector. He graduated in marine environmental science at the University of Oldenburg in 2005, and has further qualifications in environment and resource management, development studies, and integrated coastal resource management.

Pavol Varga is a graduate of the University of Prešov, Slovakia. He is a geographer and ecologist with practical experience as a project manager at the municipal level. As a fellow of the Social-Ecological Research Group GETIDOS at the University of Greifswald, Germany, he is pursuing research into social change in Slovakia, in co-operation with the NGO People and Water. Varga is a co-author of *Water without Borders: Climate Stability of Regions with Water* (2010).

Dr Rafael Ziegler studied philosophy and economics at the London School of Economics and McGill University. He has lectured at McGill, ECLA, and FU Berlin. He currently coordinates the Social-Ecological Research Group GETIDOS at the University of Greifswald, Germany, and at the IÖW Berlin. His publications include a critique of the sustainability indicator ISEW; *An Introduction to Social Entrepreneurship* (2009), and 'The Politics of Operationalisation', *Environmental Politics* (2009).

1 Strong sustainability and the role of fresh water

In the theory of sustainability, the central questions are - What to sustain, for whom, and why? - and an explicit normative stance is required to answer these (Dobson, 1998). The theory of strong sustainability proposed by Konrad Ott and Ralf Döring (2004) demands inter- and intra-generational justice. This in turn, draws on the capability approach of Nussbaum (2000) and Sen (1999) - the view that a just society will focus on the capability or effective freedom of people to achieve functionings. Nussbaum (2006 :76ff) has developed a list of capabilities and argues that justice requires these capabilities be met. However, as Ott and Döring point out, these capabilities are contingent upon the relationship humans have with their environment. Being in good health, for example, depends on good quality drinking water and clean air. Therefore, a case can be made for preserving the environment in order to meet a minimum criterion of justice.

Further specification of this case leads to a discussion of 'natural capital'. Paraphrasing Eric Neumayer (2003), one might define natural capital as the totality of nature – resources, plants, species and ecosystems – that provides humans with the capability for basic functionings. The issue in any debate over sustainability is whether natural capital should be conceptualised as substitutable or not. That is, the theory of sustainability addresses natural capital as a contested concept. If natural capital were substitutable by regulating ecosystem services with technological devices, then sustaining it would not be a primary concern. The responsible action in this case, would be to make sure that substitutes are available to meet basic capabilities and this might be ensured via efficient markets. This position is known as weak sustainability, and it is favoured by many environmental economists. Conversely, if a form of natural capital is not substitutable, then it is critical to sustain it as a primary goal. Ecological economists such as Costanza and Daly (1992) identify this as an argument for strong sustainability.

In line with the international policy discourse on sustainability typified by the Millennium Ecosystem Assessment (MEA, 2005), this paper conceptualises fresh water as natural capital. According to the MEA, ecosystem services are the benefits that people obtain from ecosystems. The MEA working groups list ecosystem services directly linked to people's needs and wants as provisioning, regulating, and cultural. In addition, it names supporting services that frame and maintain the former processes. Table 1 illustrates the link between these categories and the direct and indirect human benefits obtained from freshwater. The table is illustrative rather than a comprehensive account of the human-nature relation.

Table 1   Some examples of the role of water in human-ecosystem services

Ecosystem services	*Examples of the role of water*
Supporting	
Soil formation	transport of nutrient matter
Primary production	photosynthesis
Regulating	
Climate	local cooling by evaporative processes
Disease control	hygiene and waste treatment
Provisioning	
Nutrition	drinking water, farming, industrial processes
Biochemicals	growth of medicinal plants
Cultural	
heritage	settlement by lakes and rivers, sense of place
education	understanding of complexity
aesthetics	beauty and integrity of water bodies
spirituality	wild rivers and groves

The table shows some of the ways in which water benefits humans - with many services directly linked to basic capabilities. A single ecosystem service of water might be substituted with high energy outlay, for example, a shortage being made good by water imports. But water as a fundamental element of life and the medium of complex interactive ecosystem functions is a critical natural capital that cannot be substituted for. Water is the 'bloodstream of the biosphere' (Ripl, 2003) with a finely tuned system of arteries and veins. In relation to the criterion of strong sustainability, fresh water as a regenerating fund must be sustained for present and future generations. Ecologically sustainable behaviour then would not affect the capacity of fresh water to regenerate itself, or negatively affect its multi-functional role in ecosystem services.

This section has introduced two aspects of the theory of strong sustainability: a) its normative core in the capability approach to justice, and b) its conception of the environment as non-substitutable natural capital. It has outlined the role of fresh water in the ecosystem, and concluded that the multiple contributions of fresh water support the case for strong sustainability. The paper now considers the question of how implementing the NWP might promote strong sustainability.

2 New and Old Water Paradigms

The New Water Paradigm (NWP) proposed by Michal Kravčík, Jan Pokorný, Juraj Kohutiar, Martin Kováč, and Eugen Tóth (Kravčík et al., 2008) focuses on the small water cycle. Its authors argue that the importance of this cycle in regulating local and regional climate has been overlooked in the old water paradigm (OWP). Under the NWP, the free saturation of landscape with water restores the small water cycle by increasing evaporation/ evapotranspiration. In this process, plants function as climatisation 'valves' leading to cloud formation and renewed precipitation on the land. The water in the unsaturated zone that is formed by precipitation and is available to plants is known as 'green water' (Hoff et al., 2009). The energy dissipating characteristic of water in the small water cycle reduces extreme local weather events such as heavy rains and storms and it also results in fewer droughts. The ability of water to consume solar energy in the evaporative process has a cooling effect, whereas dry surfaces convert solar energy into sensible heat. Drained land, rural or urban, is often a result of uninformed agricultural and urban policies. Changes in land use such as 'melioration' of agricultural land, paved urban surfaces, artificial straightening of waterways can mean that more and more water gets 'lost from the continents to the oceans' (Kravčík, 2009). The small local water cycle is 'opened' and its regulative function destroyed. The effects are accelerated runoff because of dry, less permeable soil; drying of the landscape creates islands of sensible heat; these in turn prevent clouds formed above the oceans from moving in over the land. There is an increasing loss of water from the landmass of continents to oceans. These changes result from activities guided by the OWP. The argument of NWP authors focuses on central Europe and especially Slovakia, but the OWP is a variation of a larger international development known in the as the 'hydraulic mission' (Molle et al., 2008).

With industrialisation and economic development, the demand for water by industry, agriculture, and private households began to exceed the technical capacity of water supply in Slovakia in the 1940s (Szolgay et al., 2009). Industrialisation also increased the demand for energy. Large dams were built to improve water supply and energy production. An example is Vážska kaskáda (Vah’s Cascade). This system consists of 22 hydropower stations, most of them in service since the 1940s and 1950s. In 1975, the Liptovská Mara dam was added to this cascade. With a total volume of 365 million m^3, it became the largest Slovak water dam by volume. This dam was built for flood prevention, and to create water reserves for irrigation during the summer in western Slovakia. Other large dams are the Vihorlat dam, built in 1965 with a volume of 334 million m^3, the Veľká Domaša dam, built between 1962-67 with a volume of 172.5 million m^3, and the Starina dam, built from 1976-88 with a volume of 59.8 million m^3. Vihorlat and Veľká Domaša were built for flood protection and water supply for industry and agriculture. The Starina is used as a reservoir for drinking water. In total, the Slovak National Committee on Large Dams registers 50 large dams (SNCLD, 2010). Almost half of these dams were built during the 1950s and 1960s. Currently, an amount of 2399.24 MW of hydropower accounts for almost 30% of energy production in Slovakia (SPC, 2010). These large engineering structures replaced many small structures. According to the inventory of water works made by financial authorities in Slovakia in 1930, more than 2650 small water power plants were in service producing hydropower in Slovakia (Dušička et al., 2010). Most of these are no longer in use, or only serve recreational purposes.

From a sustainability perspective, the account of the OWP is incomplete without an accompanying account of changes in land use. In particular, with the communist post-WWII agricultural policy of common ownership, state melioration favoured large-scale, agroindustrial land parcels. Statistics reported an increase of agricultural productivity by 40% according to the five-year-plan (Assembly at 1959; CCSDPL, 2010). This meant the conversion of non-agricultural land, like meadows, forests and wetlands of the east Slovak lowlands into homogeneous arable land (Kvitkovič and Tarábek, 1986).

The melioration program was accompanied by a sustained effort to drain agricultural land and the drainage system introduced massive efforts in water management. Slovakia's system of drainage channels now has a length of 15.154 km, of which one third are artificially regulated rivers (MASR, 2000). Land was drained to extend agricultural areas and to increase the production of crops such as wheat. The 'conquest of the land', lowlands and valleys was guided by the ideal of food sufficiency and the goal of producing wheat, barley and maize. Wheat is a grass originating from the warm Fertile Crescent of Western Asia and it requires drier soils than the Slovak lowlands initially offered (Kováč, 2009).

This state driven transformation of water management and land is a Central European version of the hydraulic mission. The mission and OWP entail the construction of significant hydraulic infrastructure to capture as much water as possible for human use (Partzsch and Ziegler, 2009: 4ff). Although its implementation relies on powerful governmental agencies, this is not necessarily a communist approach; rather, it is characteristically modernist (Scott, 1998). Thus, a version of OWP can be recognised in the work of the US Bureau of Reclamation and the US Army Corps of Engineers. The hydraulic mission draws on a faith in the power of science and engineering. It is unchecked where civil society is relatively weak or absent. Modernist programs can be observed in both capitalist and communist states.

The ecological consequences of the OWP can be listed as follows (ZMOS, 2008):

- drying up and warming of the land (especially agricultural and urbanized areas);
- decreasing biodiversity and decreasing presence of functional vegetation in the landscape (genetic and natural heritage);
- advancing soil erosion;
- long term changes in levels and distribution of precipitation;
- deteriorating quality of available ground and surface water resources;
- a correlation between changes in the landscape and changes in the climatic regime
- increase of extreme weather related events like floods, droughts, heat waves, and forest fires.

Social consequences of the OWP include:

- reduced influence of the community and municipality on management of water resources in their area;
- municipality and community passively bear consequences of inadequate protection;
- low awareness by water and soil users of their responsibility for resource protection;

- large infrastructure projects tend to exceed costs with revenues lower than expected;

- long recovery time for investment and further costs when dams are decommissioned;

- projects of this kind are open to the dissipation of public funds through manipulation of costs and benefits;

- deference to experts and unwillingness to consult affected locals (Hanušin et al., 2000).

This complex of ecological and social problems led Michal Kravčík, Jan Pokorný, Juraj Kohutiar, Martin Kováč, and Eugen Tóth to propose the NWP.

3 The New Water Paradigm - strongly sustainable?

As the core of the NWP argument draws on an ecological analysis, some further clarification of the meaning of ecological sustainability is in order. Ecological sustainability as used here refers to a quality of human behaviour. A certain behaviour can be called ecologically sustainable if it does not negatively affect the resilience of an ecosystem. In ecosystem sciences, the concept of resilience characterizes the capacity of the system to reorganize and renew after disturbances, thus maintaining a functional structure within its system boundaries. Key factors of resilience include functional diversity with overlaps and redundancy at different scales within an ecosystem (Peterson et al., 1998). Functional diversity has two aspects: first, it refers to the diversity of functional groups such as producers or predators; and second, it refers to functional-response diversity or different ways of responding to stress (Folke et al., 2004). The distribution of response and effect within, and across scales, is critical to the ecological resilience of an ecosystem. The overlap of ecological functions of different species guarantees the persistence of the system in case a species is removed. Species with a function that is not fulfilled by another species, are key or keystone species in the functional structure of the system. Resilience can be lost by a) adding or removing key substances or resources such as excessive nutrient input or contamination; b) changing transport regimes; or c) manipulations of keystone ecological processes, such as introducing species representing a new functional type.

The disturbances that occur in any ecosystem are not necessarily detrimental. In fact, the suppression of disturbances by humans may actually leave a system vulnerable. Disturbances can create variation, give space for renewal, and thereby build or maintain resilience (Colding et al., 2003). Traditional ecosystem management normally uses historic conditions as reference points. Steady-state resource management normally seeks to reduce natural variation in target resources so as to be able to calculate outputs. But neither of these approaches is entirely adequate, because ecosystems change over time. Ripl (2003) states that ecosystems naturally tend to develop towards closed, short-circuited matter and energy cycles, thus minimizing losses.

This tendency to closure indicates a mature community-based ecological structure with a higher level of linking and coupling than during the pioneer stage. If engineers or farmers aim to 'freeze' an ecosystem in a certain state, this may leave it more vulnerable to disturbances than before by channeling processes, reducing ecological functions on different scales, and thus diminishing cross-scale resilience (Peterson et al., 1998). But judgments about long-term ecosystem development in ever-changing surroundings are difficult because of unforeseeable perturbations. The complexity of forecasting means that much more research remains to be done on the effects of climate change on hydrological cycles. The effects of global warming on groundwater may be positive or negative, depending on regional conditions (Kovalevskii, 2007). A high degree of uncertainty inevitably attaches to ecological predictions (Carpenter, 2002).

Water is a very complex resource. In contrast to a more or less non-moving resource such as soil, fresh water occurs in a very dynamic cycle of rain, runoff, percolation and evaporation/evapotranspiration, with enormous temporal and spatial variations as well as variations in quality like nutrient flows. Water is the most prominent agent of ecosystemic transport, reaction and cooling (Ripl, 2003). On a very small scale, water is crucial for internal cellular processes, whereas on a large scale, its energy dissipating quality may have an important effect on at least the local climate (Pokorný, 2001). This makes fresh water a key resource for ecosystems at every level. Due to its very complex and basic role, water is not substitutable and can readily become a limiting resource. Anthropogenic changes to the water cycle by actions like withdrawal, pollution, changing river beds or land use, may have far reaching impacts on ecosystems (Folke and Falkenmark, 2002; McKay and King, 2006). For example, land use changes may not only directly affect the functional diversity of an ecosystem by disturbing species niches and communities. Land use changes indirectly affect the general water balance - upsetting matter and energy transport processes, or reducing moisture availability for the biosphere. The extent, to which a change in land use may alter the functional diversity of an ecosystem, is something that has to be evaluated in the specific local context. But it is a given that ecologically sustainable behaviour should not affect the capacity of the hydrological cycle to regenerate itself, nor undermine its multifunctional role for ecosystem services.

In order to illustrate the implications of the NWP, two aspects of ecological management are highlighted:

> **Management implication: Local water retention in landscapes and cities**
> The principle of keeping as much water as possible in landscapes and cities affects a) the availability of water, b) matter transport processes, c) local temperatures.
>
> a) Slowing down the process of runoff will increase the volume of fresh water that infiltrates the soil thereby supporting plant growth and replenishment of groundwater aquifers. The saturation of the landscape with water may thereby help to guarantee that water with its complementarity in use does not become a limiting factor – bearing in mind that the aim lies not only in sustaining the ecosystem per se but also in supporting its capability of providing multiple ecosystem services for society (Chapin III et al., 2010). The bulk density of the soil with regard to aeration is of importance here as well. The range of water content in the soil that enables the growth of vegetation lies between the permanent wilting point of water content on the low end to field capacity on the high end (Leao et al., 2005). By guaranteeing water availability for plants as producers and the other species within the ecosystem, functional diversity is held intact. In dry areas inhabited by a few species, the introduction of water opens opportunities for establishing more diverse communities thereby increasing resilience. With regard to quality of water, an intact, uncontaminated ecosystem has a certain level of water-purifying capacity. But

the implementation may also bear risks: for example, building high numbers of cascade ground tanks for rain water harvesting in a landscape may affect the ecosystem in an unpredictable way. The proposed retention measures have therefore to be closely evaluated in advance taking into account the local context. The evaluation should also take into account the principle of uncertainty mentioned above.

b) A key requirement for sustainability is to minimize matter losses, such as soil base cations as nutrients from the landscape to the oceans (Ripl and Hildmann, 2000). By reducing the superficial runoff, less matter is washed out of the system. In general, steep moisture gradients may lead to an acceleration of matter transport (Ripl and Hildmann, 2000). By keeping water in the landscape, steep moisture gradients are smoothed out. Matter remains integrated in local matter cycles within the ecosystem.

c) Though the focus of the NWP lies not in optimizing water management in agriculture, green water is strongly taken into account in the paradigm: higher rates of evaporation/evapotranspiration have at least local cooling effects. Further research has to be done on the question of how far extreme weather events and global warming are affected by local or regional cooling by wetting the landscape. It has been shown that greening roofs and walls within a city has a temperature-decreasing effect (Alexandri and Jones, 2008). NWP advocates maintin that such cooling will reduce local weather extremes. The reduction of weather extremes should lessen disturbances and stress to the ecosystem.

A significant side effect of the cooling of cities by green roofs or other measures to keep moisture within the city is a decrease of energy demand for air conditioning (Alexandri, 2005). The reduction in energy consumption is a further important aspect of sustainable behaviour.

Management Implication: A catchment-based perspective
Adopting the catchment as the primary unit of rain water collection and retention makes good sense, particularly where the focus is on the small hydrological cycle. A sustainable management approach should take into account the whole range of natural connectivity (Low et al., 2003).

This discussion of ecological sustainability and management implications indicates the coherence of NWP principles with strong sustainability: water is handled as a non-substitutable resource, which should be kept in local cycles as far as possible. Moreover, by the NWP argument, only fresh water management in relation to ecosystems will deliver the full range of ecosystem services.

4 The New Water Paradigm and human capabilities

Strengthening the small water cycle increases water availability in an ecosystem, and this promotes its functional diversity. Functional diversity is at the core of sustained ecosystem services, and by implication this diversity regulates human provisioning. Ecosystem services are a precondition of basic capabilities. Breena Holland proposes a concept of 'meta-capability'. This is defined as 'being able to live one’s life in the context of ecological conditions that can provide environmental resources and services that enable the current generation's range of capabilities; to have these conditions now and in the future' (Holland, 2008: 324). By means of its contribution to ecological sustainability, the NWP approach seems to contribute to the possibility of sustained basic capabilities. However, this general claim needs to be explored in relation to specific capabilities. To this end, the implications of the NWP in relation to Nussbaum's list of capabilities are now explored, and all quotes in the following paragraphs are from Nussbaum (2006: 76ff) unless otherwise indicated.

To the extent that the NWP reduces extreme weather events such as storms and droughts, it contributes to Nussbaum's first two capabilities - bodily health, including adequate shelter and 'being able to live to the end of a human life of normal length'. Nevertheless, this contribution may need qualification for three reasons. First, the NWP requires more empirical evidence and observation regarding its mitigation of extreme weather events. Second, the cumulative effect of local NWP implementation might introduce unforeseen consequences such as water born disease due to small open water holdings. Finally, the contribution of the NWP to these capabilities is conditional upon appropriate social policies and interventions.

In terms of the capability of 'bodily integrity', that is, being secure against violent assault, water scarcity increases the likelihood of conflict. The contribution of the NWP is therefore conditional upon its ability to roll back desertification using rain water management techniques. Here too, more empirical studies and experiments are called for. The relation between water scarcity and conflict is likely to be more important at regional and local levels where land-use and land-ownership are particularly relevant (Fröhlich, 2006: 33). The hydraulic mission relies on large-scale expert projects advanced by powerful state agencies or large corporations. In theory, these organisations are directly or indirectly accountable to the state, and in democracies to the people as well. Yet in practice, accountability has proven very difficult to achieve.

By contrast, the NWP proposes an approach to political control based on a different unit - not the state, but the catchment. These catchments are nested giving rise to a need for upstream and downstream co-operation, that is, of eco-hydrosolidarity (Folke and Falkenmark, 2010). The catchment perspective offers three sources of solidarity:

- members of a catchment have to co-ordinate their actions qua membership in the catchment (solidarity based on commonality);

- there is the mutual advantage of coordinated actions and functions (solidarity based on differentiation); and finally,

- there is the catchment as a community of risk in view of floods and droughts (solidarity based on shared risk).

Thus, the catchment perspective offers one articulation of the basic capability of affiliation: 'being able to live with and toward others'. In practice, the NWP might enhance one dimension of affiliation via effective participation in the integrated management of water and land in a catchment. Note, however, that this participatory commitment is not a necessary corollary of the ecological idea of the NWP, since catchment based management might be decided on and implemented by state experts. However, the capability approach regards effective political participation as a basic requirement of justice. The NWP might indeed increase political participation through designs for catchment based integrated water management; although again, this contribution is conditional upon a social commitment to participate. Local communities might simply not prioritize the NWP over established ways of producing or new commercial opportunities. There are a number of challenges to implementing the NWP, given established routines and priorities, many people's disinterest in participation and preference for delegating responsibility to experts.

As far as the capability of 'economic control over one's environment' is concerned, the NWP in conjunction with a commitment to political participation seems to promote economic control by means of its nested, catchment-based water management. Moreover, it has been suggested that the NWP offers possibilities for job creation in the sphere of landscape reuse and fresh water retention in rural and urban domains. Experience with rain water harvesting by the Barefoot College in India indicates that such jobs do not necessarily require special skills and can usefully draw on a local workforce. Even so, major challenges regarding land ownership and land use may intervene in the implementaion of such a scheme. Proponents of the NWP demand increased water retention, and this directly affects land use, particularly in agriculture. Thus Nussbaum's capability for 'being able to hold property, both land and moveable goods, and having property rights on an equal basis with others' might have to be subordinated to ecological considerations. In the context of a theory of justice, the subordination of property, especially for productive use, to such fundamental considerations seems compatible with the capability approach. Yet, in practice, it may be realistic to expect conflicts with existing property regimes. In dealing with such tensions, the model of differentiated land use for nature conservation developed by Ott and Döring (2004: Chapter 5) could be a helpful starting point. The questions now become - Which areas or locations are particularly important for water retention; which areas are particularly suitable for agriculture; and what 'balance' of land use does this suggest?

The large dams and irrigation systems of the OWP and the hydraulic mission have proven disruptive to millions of people, forcefully dislocated. Now the capability of 'being able to have attachments to things and people outside ourselves', to 'live with and towards others', to 'being able to use the senses, to imagine, think, and reason' is at least weakly related to a 'sense of place' and the cultural, religious and spiritual aspects of environmental experience (Holland, 2008: 323). The catchment based NWP approach may well foster and sustain a 'sense of place', and by implication the related capabilities. However, people also develop a 'sense of place' regarding a dam or rectified river. Likewise, possibilities for 'play' in the recreational sense develop in and around the 'temples' of the OWP. Could the transition to the NWP have similar psychological effects to that of the earlier transition to the OWP? Arguably this concern can only be reduced with a commitment to effective political participation. Already, the absence of such a commitment has been a major reason for social conflicts surrounding the hydraulic mission. The inclusion of a commitment to participation may contribute to a more sustainable and just transition to the goals envisaged by the NWP.

Slovak land and water management practices have come a long way since 1989. Recent legislation in that country has given local government formal, though fragmented, competencies in the field of environmental protection. There is evidence that through a combination of mutual support, national associations, and international links, some local authorities are adopting new approaches and strategies. Still, the OWP is as much a part of this country's capitalist political culture as it was during the socialist era that preceded it. At the time of writing this article, the state water company was attempting to build a large dam in Tichy Potok. Ironically, an earlier effort to build a large dam in this area was prevented by Kravčik and others in the 1990s with NWP the proposed alternative. NWP advocates have a long way to go in changing the mindset of key decision makers. Due to this challenge, it is noteworthy, that the Slovak Government started a program of landscape revitalization in the fall of 2010, which effectively will create pilot projects for water retention throughout the country.

There is no doubt that the ecological idea of strengthening the small water cycle by paying attention to 'invisible' green water and its role in vegetation and climate protection, extends the narrow blue water focus of the hydraulic mission. This extension leads to resilience, to the role of fresh water for ecosystems and their species. If citizens are involved in decision-making and implementation of the NWP on a local level, then the capability of 'living with concern for and in relation to animals, plants, and the world of nature' is prima facie strengthened, and possibly, even a spiritual dimension is added.

5 Conclusion

The discussion concludes with a comparative assessment of the sustainability contribution of the OWP and NWP respectively. In the construction of hydraulic infrastructure, the OWP disregards long-term and feedback effects on ecosystems and on human societies because its primary and singular focus is water supply. The OWP regards water as a renewable, never-ending resource without taking into account its complex cycles, time scales, and spatial distribution. Water processes and their role in ecosystem functioning are insufficiently taken into account by the OWP. This has lead to the disruption of the small water cycle, to drying out and warming of landmasses, loss of organic matter to the sea, with many negative effects on the resilience of ecosystems. A high vulnerability of ecosystems to disturbance and stress means high risk to human capabilities. In addition, capabilities such as affiliation or effective political participation are disregarded under the OWP. In short, the OWP stands in antagonistic relationship to strong sustainability.

Water in the NWP is treated as a precious, non-substitutable good. The NWP seeks to restore the capacity of fresh water to regenerate and carry out multifunctional ecosystem services by strengthening the small water cycle. According to the present analysis, it is plain that implementation of the NWP contributes to strong sustainability better than the OWP does. Nevertheless, the following aspects of the NWP merit further research:

- potential NWP effects in mitigating climate change and extreme weather events through the coupling of water and energy cycles;

- NWP links to other socio-ecological management approaches like differentiated land use including nature conservation;

- the role of uncertainty and unintended consequences in NWP implementation;

- management of the NWP in relation to changing public and professional mindsets;

- financing the provision of energy for industry and urban and rural water supply.

As with any new paradigm such open questions only are to be expected. Our analysis leads us to conclude that further work in this direction is important for justice and sustainability.

References

Alexandri, E. and Jones, P. (2008) 'Temperature decreases in an urban canyon due to green walls and green roofs in diverse climates', *Building and Environment,* Vol. 43, No. 4, pp. 480-493.

Alexandri, E. (2005) *Investigations into Mitigating the Heat Island Effect through Green Roofs and Green Walls*. Cardiff University: The Architectural Science Group.

Chapin III, F. S. et al., (2010) 'Ecosystem stewardship: sustainability strategies for a rapidly changing planet', *Trends in Ecology and Evolution*, Vol. 25, No. 4, pp. 241-249.

Carpenter, S. R. (2002) 'Ecological Futures: Building an Ecology of the Long Now' *Ecology*, Vol. 83, No. 8, pp. 2069-2083.

CCSDPL Common Czecho-Slovak Digital Parliamentary Library (2010) Original text, 33rd Session, 9 July 1959: http://fenrir.psp.cz/ (accessed 29 April 2010).

Colding, J., Elmqvist, T., and Olsson, P. (2003) 'Living with disturbances: building resilience in social-ecological systems' in Berkes, F, Colding, J., and Folke, C. (eds.), *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press, pp. 163-185.

Costanza, R. and Daly, H. (1992) 'Natural Capital and Sustainable Development', *Conservation Biology*, Vol. 6, No. 4, pp. 37–46.

Dobson, A. (1998) *Justice and the Environment*. Oxford University Press.

Dušička, P., Hodák, T. and Šulek, P. (2010) 'Historical development of small hydropower plants', *Engineering structures, professional journal*: http://www.asb.sk/ (accessed 29 April 2010).

Falkenmark, M. and Folke, C. (2010) 'Eco-hydrosolidarity: A new ethics for stewardship of value-adding rainfall' in Brown, P. G. and Schmidt, J. G. (eds.), *Ethics and the World Water Crisis.* Washington DC: Island Press, pp. 247-264.

Folke, C. and Falkenmark, M. (2002), 'The ethics of socio-ecological catchment management: towards hydrosolidarity', *Hydrology and Earth System Sciences*, Vol. 6, No. 1, pp. 1-9.

Folke, C. et al. (2004) 'Regime Shifts, Resilience, and Biodiversity in Ecosystem Management', *Annual Review of Ecology, Evolution, and Systematics*, Vol. 35, pp. 557-581.

Fröhlich, C. (2006) 'Zur Rolle der Ressource Wasser in Konflikten', *Aus Politik und Zeitgeschichte*, Vol. 25, pp. 32–37.

Hoff, H. et al. (2009) 'Greening the global water system', *Journal of Hydrology*, special issue No. 384, pp. 177–184.

Holland, B. (2008) ‘Justice and the environment in Nussbaum's 'capabilities approach': why sustainable ecological capacity is a meta-capability’, *Political Research Quarterly*, Vol. 61, No. 2, pp. 319–332.

Kováč, K. (2009) ‘Cultivation zoning and winter cereals sowing term’, *Naše pole*, Vol. 12, No. 10

Kovalevskii, K. S. (2007) ‘Effect of Climate Changes on Groundwater’, *Water Resources*, Vol. 34, No. 2, pp. 140-152.

Kravčík, M. et al. (2008) *Water for the Recovery of the Climate: A New Water Paradigm* Žilina: Krupa Print.

Kravčík, M. (2009) ‘Return the lost water back to the continents. Human Well-Being, Poverty, and Ecosystem Services’ in Ziegler, R. (ed.), *An Introduction to Social Entrepreneurship: Voices, Preconditions, Contexts*. Cheltenham: Edward Elgar, pp. 21-32.

Leao, T. et al (2005) 'An Algorithm for Calculating the Least Limiting Water Range of Soils’, *Agronomy Journal*, Vol. 97, No. 4, pp. 1210-1215.

MASR Ministry of Agriculture Slovak Republic (2000) *Green Report 1999*: http://test.uvtip.sk/ (accessed 29 April 2010).

McKay, S. F. and King, A. J. (2006) ‘Potential ecological effects of water extraction in small unregulated streams’, *River Research and Applications*, Vol. 22, No. 9, pp. 1023-1037.

Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-Being: Synthesis*, Washington DC: Island Press.

Molle, F., Mollinga, P. and Meinzen-Dick, R. (2008) ‘Water, politics and development: Introducing Water Alternatives Water Alternatives’, *Water Alternatives*, Vol.1, No. 1, pp.1–6.

Neumayer, E. (2003) *Weak versus Strong Sustainability: Exploring the Limits of Two Opposing Paradigms*. Cheltenham: Edward Elgar.

Nussbaum, M. (2000) *Women and Human Development: The Capabilities Approach*. Cambridge University Press.

Nussbaum, M. (2006) *Frontiers of Justice. Disability, Nationality, Species Membership*. Cambridge: Harvard University Press.

Ott, K. and Döring, R. (2004) *Theorie und Praxis starker Nachhaltigkeit*. Marburg: Metropolis-Verlag.

Peterson, G., Allen, G. R., and Holling, C. S. (1998) ‘Ecological Resilience, Biodiversity, and Scale’, *Ecosystems*, Vol. 1, No. 1, pp. 6-18.

Pokorný, J. (2001) ‘Dissipation of solar energy in landscape – controlled by management of water and vegetation’, *Renewable Energy*, Vol. 24, No. 3, pp.641-645.

Ripl, W. (2003) ‘Water: the bloodstream of the biosphere’, *Phil. Trans. R. Soc. Lond.*, B 358, pp. 1921-1934.

Ripl, W. and Hildmann, C. (2000) ‘Dissolved load transport by rivers as an indicator of landscape sustainability’, *Ecological Engineering*, Vol. 14, No. 4, pp. 373-387.

Scott, J. (1998) *Seeing Like a State. How Certain Schemes to Improve the Human Condition Have Failed*. New Haven: Yale University Press.

Sen, A. (1999) *Development as Freedom*. Oxford University Press.

SNCLD Slovak National Committee on Large Dams (2010) Alphabetical list of registered dams in ICOLD: http://www.skcold.sk/ (accessed 29 April 2010).

SPC Slovak Power Company (2010) General Information: http://www.seas.sk/ (accessed 29 April 2010).

Szolgay, J., Kohnová, S., and Hlavčová, K. (2009) 'Water Management: Establishment, Purpose, Definitions and Short History of Water Management', Lecture Notes, *Department of Land and Water Resources Management in Slovak University of Technology in Bratislava*, Slovakia.

ZMOS Slovak Association of Towns and Villages (2008) *Principles of Integrated Water Resources Management in Municipalities and their River Basins*: www.zmos.sk/ (accessed 29 April 2010).

Ziegler, R. and Partzsch, L. (2009) ‘The Political Biography of water and the people's biography. A Case Study of Social Entrepreneurship in the Water Sector’. Paper presented at the Amsterdam Conference on the Human Dimensions of Global Environmental Change, Amsterdam; available for download from www.getidos.net.