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DIMENSIONS OF WATER SECURITY AND THE ECOSYSTEM SERVICES CONCEPT ON THE GOVERNANCE LEVEL

A VÍZBIZTONSÁG DIMENZIÓI ÉS AZ ÖKOSZISZTÉMA KONCEPCIÓJA KORMÁNYZATI SZINTEN

The concept of water security has received increasing attention in the scientific, political and business communities in recent years. This growing interest reflects the rise in concern about the state of freshwater resources, changing hydrological cycles and their impacts on human security. Despite efforts to reform water governance at local, regional and global levels, there is still clear evidence of growing pressures on water systems across the planet.

Enhancing water security has always been related to reducing uncertainty in the delivery of water-related services and to reducing negative impacts from water-related extremes (i.e. floods and droughts). Enhancing water security in an increasingly uncertain and complex world requires water governance and management systems to perform under conditions of irreducible uncertainty and surprise.

Growing water scarcity, increased water variability due to climate change and rapidly deteriorating water quality have led to a proliferation of definitions and publications on the topic of water security. Water is an essential component of all ecosystems, not just aquatic systems. Typically, the provision and use of water for human needs requires relatively predictable or stable supply, which is in direct contrast to the importance of variability in river flows that is vital for aquatic ecosystems.

The author reflects of this article, mainly is to elaborate on the trade-offs between human water security on the one hand and environmental water needs on the other, on the governance level.

***Keywords**: water security, ecosystem, human health, livelihoods, governance.*

A vízbiztonság koncepciója az elmúlt években egyre nagyobb figyelmet kapott a tudományos, politikai és üzleti világban. Ez a növekvő érdeklődés az édesvízkészletek állapota, a vízkörökben beálló változások és azoknak az emberiség biztonságára gyakorolt hatása iránti növekvő aggodalmat mutatja. Annak ellenére, hogy a vízügyi szabályozást helyi, regionális és globális szinten is meg kívánják reformálni, továbbra is egyértelmű bizonyítékok vannak arra, hogy bolygónk vízrendszereire növekvő nyomás nehezedik.

A vízbiztonság növelése mindig hozzátartozott a vízhez kapcsolódó szolgáltatások bizonytalanságának csökkentéséhez és a vízhez kapcsolódó szélsőségek negatív hatásainak (mint amilyen az árvíz és a szárazság) mérsékléséhez. A vízbiztonság növelése egy egyre bizonytalanabb és összetettebb világban megköveteli, hogy a vízügyi szabályozás és a vízgazdálkodási rendszerek nem csökkenthető bizonytalansági és meglepetés tényezők között teljesítsenek.

A növekvő vízhiány, az éghajlatváltozás miatti növekvő vízingadozás és a vizek minőségének gyors romlása a vízbiztonság területén a meghatározások és a publikációk elterjedését idézte elő. A víz nem csak a vízi rendszerek, hanem minden ökoszisztéma lényeges összetevője. Jellemzően a víz humán célokra történő szolgáltatása és használata alapvetően kiszámítható és stabil ellátást feltételez, amely szöges ellentétben áll a vízfolyások változékonyságának fontosságával, amely létfontosságú a vízi ökoszisztémák számára.

A szerző fő célja a cikkben bemutatni, hogy milyen kompromisszumok azok, melyek egyrészt az emberi vízellátás biztonsága érdekében s másrészt a környezeti vízigények biztonsága érdekében köttetnek kormányzati szinten.

***Kulcsszavak**: ivóvíz biztonság, ökoszisztéma, emberi egészség, megélhetés, kormányzás.*

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CHARACTERIZING WATER SECURITY

The sustainable management of global water resources is one of the most pressing environmental challenges of the 21st century, which affects the lives of billions of people. At the global scale freshwater resources are not yet scarce. However, their uneven distribution at different scales (among world regions, countries, social groups) can provide multiple sources of tension. Technological progress has allowed the cultivation of deserts and floodplains. In return, pushing human activities towards or even beyond the capacities of environmental systems has resulted in many regions having high vulnerability to environmental extremes, unsustainable land use patterns and degradation of ecosystems.[2] Water security has often been narrowly defined, focusing on short-term human water security only to the detriment of environmental water needs (e.g. increase of water purification and regulation potential reducing biodiversity functions) with potential negative long-term consequences for human water security as well. To assure long-term sustainability, water security has to be addressed from an integrated social-ecological systems perspective.

The main objective of this article is to elaborate on the trade-offs between human water security on the one hand and environmental water needs on the other. Thereby it is crucial to take economic interests and livelihoods, especially of poor communities, into account. In most countries, economic considerations prevail over environmental requirements, often resulting in the degradation of ecological processes and functions, which in turn affects, in particular, marginal groups and destroys livelihoods.

The increasing concern about sustainable solutions for water security led Grey and Sadoff to develop a comprehensive approach by defining water security as "…the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economics"[3]. This definition identifies four dimensions of water security and highlights economic, social and environmental trade-offs as matters of concern. Figure 1 captures such a broader definition of water security and highlights some dynamic aspects in a very simplified scheme. Water governance and management systems regulate and manage water-related services provision and risks from water-related hazards affecting different uses and users (including the environment). Water security is an emergent property of these interactions. Environmental (e.g. environmental flows), social (e.g. equitable access to water of sufficient quantity and quality) and economic (e.g. secure water supply for agricultural production, protection from flood damage) dimensions of water security may be in synergy or in conflict with each other. The perception of water security and potential trade-offs affects governance and management of hazards and services. These interactions are embedded and strongly influenced by the socio-environmental context. Different climatic and hydrological conditions pose different challenges to water security.[4] The state of economic and institutional

[2] Pahl-Wostl C. (2007.) 'Transition towards adaptive management of water facing climate and global change'. Water Resources Management, 21(1), 49-62.
[3] Grey D. And C.W. Sadoff (2007.) 'Sink or swim? Water security for growth and development'. Water Policy, 9. 545.
[4] Grey D. And C.W. Sadoff (2007.) 'Sink or swim? Water security for growth and development'. Water Policy, 9. 545.

development determines priorities and resources available, to name only a couple of the multitude of factors influencing water security.

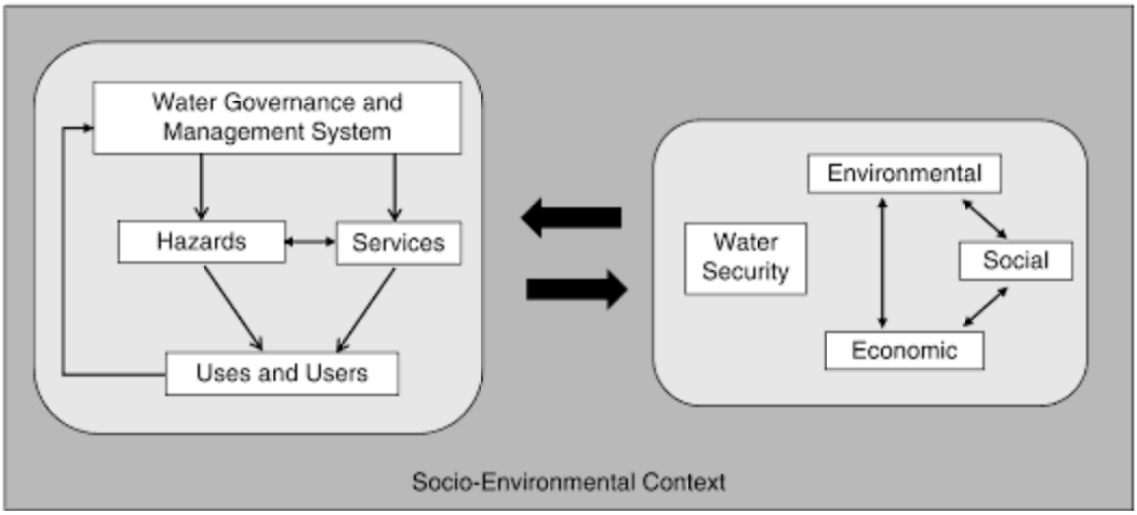

Figure 1.: Conceptual framework for characterizing water security (In.: Pahl-Wostl C. (2009.) 'A conceptual framework for analyzing adaptive capacity and multi-level learning processes in resource governance regimes'. (http://www.gwsp.org/fileadmin/downloads/Publications/Pahl-Wostl__2009_-_A_conceptual_framework_for_analysing_adaptive_capacity_and_multi-level_learning_processes_in_resource_governance_regimes.pdf (Downloaded: 2017.03.30.)

By using the attribute "acceptable" Grey and Sadoff take the position that water security is a social construct which must be negotiated in a social discourse. Hence, governance and in particular the respect of good governance principles are central to defining and implementing an integrative and thus sustainable approach to water security. Governance takes into account the political, social, economic and administrative systems including different actors and networks that help formulate and implement water policies at different levels of society [5]. Good governance principles embrace participation, accountability, transparency, responsiveness, consensus orientation, effectiveness and efficiency, equity and inclusiveness, and respect for rules of law (UNESCAP, 2009.).

This article is based on the argument that the major governance challenge is the need for institutional settings which could support negotiation about water security trade-offs within a guiding logic and an integrative framework. Otherwise the conflict between human development and environmental conservation in general, and human water security and environmental water needs in particular, will further increase. The Millennium Ecosystem Assessment (MA) embarked on investigating the relationship between human development and the state of the environment based on assessing changes in ecosystem services and the benefits they provide for human well-being. The alarming trends towards increasing ecosystem degradation identified by the MA more than a decade ago have not been reversed

[5] Pahl-Wostl C. (2009.) 'A conceptual framework for analyzing adaptive capacity and multi-level learning processes in resource governance regimes'. Global Environmental Change, 19, 354-365.

despite more emphasis towards integrative environmental policies and regulatory frameworks in both developed and developing countries.[6]

I argue that the ecosystem services concept may serve as a bridging concept to support integration of fragmented institutional settings and to support negotiation about water security trade-offs within a guiding logic and an integrative framework. However, its application needs to be combined with appropriate governance settings. Different governance modes (bureaucratic hierarchies, markets, networks) associated with their different logics in setting targets and assessing risks need to be integrated. An integrated management of ecosystem services requires a combination of governmental command-and-control, market tools and community-based settings. These so-called hybrid regimes are more effective (compared to pure markets or hierarchies) to deal with complex governance challenges derived from the characteristics of ecosystem services (e.g. their common good character, degree of excludability and subtractability)[7].

DIMENSIONS OF WATER SECURITY

In their water security definition Gray and Sadoff identify four dimensions: health, livelihoods, ecosystems and production. Operationalizing the concept of water security requires defining procedures for setting targets for the four domains[8]. I distinguish four approaches for doing so which differ in the kind of knowledge used, in the institutional setting and in the actors involved:

- Scientific analysis and expert judgement;
- invoking widely shared societal norms;
- economic cost-benefit types of analyses; and
- place-based assessment of perceptions of concerned stakeholders.

Scientific analyses and technical expertise typically inform regulations, for example, to set thresholds for pollutants in the environment. Thresholds are defined by expert judgement based on what is considered to be an acceptable risk to people or the environment. How to determine what is an acceptable risk is by no means evident and may be subject to controversial negotiation.

Societal norms typically dominate the discourse on an equitable sharing of resources and the provision of basic services to societal groups. The human right to water guarantees priority of basic human water needs over other potentially competing uses. Societal norms would not allow water required for human survival to be treated as an economic good.

Economic cost-benefit types of analyses dominate arguments about risks to economic production. Expenses to implement certain environmental standards may be perceived as

[6] Brown K. (2009.) 'Human development and environmental governance: a reality check.' In N. Adger and A. Jordan , Governing Sustainability, pp. 32-51.
[7] Muradian R. and L. Rival (2012.) 'Between markets and hierarchies: the challenge of governing ecosystem services', Ecosystem Services, 1 (1), 93-100.
[8] Pahl-Wostl C., M.A. Palmer and K. Richards (2013.) 'Enhancing water security for the benefits of humans and nature – the role of governance', Current Opinion in Environmental Sustainability, 5-6, 676-684.

being excessive and serious threats to economic viability. Encompassing cost-benefit analyses aim at expressing all costs and benefits in monetary units as potential means of integration. Risks can be quantified by combining costs of an event with the probability of its occurrence. However, such an approach imposes the logic of one governance mode, the market, onto other kinds of consideations.

Place-based assessments may be used to negotiate regional targets by affected stake-holder groups. Participatory processes are no panacea though for achieving equitable and transparent negotiation processes and for developing a perspective embracing long-term sustainability. I argue that the ecosystem services concept could provide a holistic frame to negotiate trade-offs from a holistic perspective provided its implementation is linked to innovative and integrative governance settings.

Ecosystem services can be defined as "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life"[9]. Many environmental problems and seeming trade-offs between human water security and environmental water needs arise from negligence or ignorance of the role of vital ecosystem services and the implications of overexploiting some services thereby eroding the functional base of others and even generating new sources for environmental hazards. A case in point is in traditional flood management to protect human settlements. The regulation of rivers and the concomitant disappearance of floodplains has resulted in a degradation of riverine ecosystems and in a loss of the natural buffering capacity of the landscape. This in turn has led, in combination with the sealing of land surface, to increased flood damages. A seemingly simple solution to reversing undesirable developments for both human security and environmental health should be to make such interdependencies explicit. Such arguments dominate national and international discourse but changes towards more integrated flood management practices are slow.[10]

WATER SECURITY TARGETS

Water security for human health

Targets set from a human health perspective are most often defined through scientific analyses and expert judgement. Health-related water security thresholds, for example, for drinking water, are set by science-based regulations. From an ethical perspective (human) health standards are not negotiable. If a pollutant has severe implications on human health it needs to be banned regardless of expense. Uncertainties and controversies may prevail though on the severity of long-term impacts. In such cases arguments have been made to adopt the precautionary principle. This principle places the burden of proof that an intended action or policy does not constitute a risk to the public or the environment on those causing this

[9] Daily G.C. (1997.) Nature's Services: Societal Dependence on Natural Ecosystem. Washington, DC: Island Press.
[10] Pahl-Wostl C. (2006.) 'The importance of social learning in restoring the multifanctionality of rivers and flood-palins' Ecology and Society, 11 (1), 10. http://www.ecologyandsociety.org/voll/iss1/art/.

potential risk.[11] What is acceptable as evidence may be highly controversial and requires appropriate governance settings for deliberation and conflict resolution.

Even when stringent environmental regulation is in place, implementation and enforcement may remain a challenge in countries where formal institutions are weak. Direct trade-offs between water security for human health and water for the environment are rare. Concerns about hygiene and human health were even a strong driver for water quality improvements which also benefited the environment. And functional ecosystems benefit human health. For example, the biological component of the groundwater environment provides an important service in the form of water purification and waste treatment through the microbial degradation of organic compounds and potential human pathogens.[12]

This an example of the importance of systemic thinking and the recognition of a wide range of ecosystem services to identify and realize synergies between water security for human health and environmental water needs.

The Water Safety Plan (WSP) is appropriate tool to detect the risks of the drinking water supply system and to develop the public health and security. The plan provides freshwater in state of best quality[13].

Water needs of the poor and water security for livelihoods

Water needs of the poor and water security for livelihoods implies guaranteeing basic water-related services for a self-determined life. This goes beyond survival to include the material base for sustaining a life of dignity. Such needs are addressed by UN Millennium Development Goal (MDG) 7 which targets sustainable access to safe drinking water and basic sanitation. Water security for livelihoods implies as well that marginalized groups are not deprived of access to, for example, fisheries, farmlands or small-scale tourism. Water security targets in this domain are defined by societal norms and place-based assessments of the perceptions of stakeholders, although higher levels of governance may set the tone of the debate (e.g. MDGs or UN Resolution 64/292 recognizing the human right to water and sanitation (UNGA, 2010)). Trade-offs between water security for livelihoods and for the environment are common, in particular when traditional structures and practices are disrupted or lost, and when production needs are in conflict with environmental water requirements. At the same time livelihoods are vulnerable to the loss of water-related ecosystem services (e.g. wetland functions).[14]

[11] Jordan A. and T. O'Riordan (2004.) 'The precautionary principle: a legal and policy history', in M. Martuzzi and J.A. Tickner, The Precautionary Principle: Protecting Public Health, The Environment and the Future of Our Children, pp.31-48. Geneva, Switzerland: World Health Organization.

[12] Herman J.S., D.C. Culver and J. Salzman (2001.) 'Groundwater ecosystems and the service of water purification', Stanford Environmental Law Journal, 20, 479-495.

[13] Berek Tamás – Dávidovits Zsuzsanna: Vízbiztonsági terv az ivóvízellátás minőségirányítási rendszerében, 2012. Hadmérnök.

[14] Forslund A., B.M. Renöfalt, S. Barchiesi and K.E.A. Cross (2009.) Securing Water for Ecosystems and Human Well-Being: The Importance of Environmental Flows, Swedish Water House Report, Stockholm:SIWI.

Water security for economic production

Water security for different production activities in different economic sectors depends on supply, re-use and treatment, all of which introduce costs to the production process. What is affordable may be determined by cost-benefit analyses, but strategic considerations and national interests (e.g. food sovereignty, survival of traditional industries) also intervene. Water may be treated as an economic good for production activities, implying that market forces determine the level of water security affordable for certain sectors. However, consumption also leads to pollution, and is frequently spatially separated from production, and therefore influences water security elsewhere. Conflicts between water security for production and environmental integrity are frequent. In particular in fast developing economies such as China problems abound.[15]

Each of the domains health, livelihoods, ecosystems and production has followed a different approach and framing of how to set targets for water security. This has posed a considerable governance challenge and often governance failure with respect to addressing trade-offs. Increasingly, the concept of ecosystem services is used to represent the benefits of respecting the water needs of the environment both through the effect of the concept on policy discourse, and its introduction of a financial metric.[16] It is a matter of governance to determine whether, and why, to include ecosystems and the environment in the assessment of demand for water, and to identify mechanisms and procedures that can give ecosystems and the environment a voice. Equally, it is for the governance regime to determine if this requires a form of financialization of ecosystems to what extent such valuation is a function of social and ecological context, or if this corrupts attitudes to ecosystems.[17] Governing such transformation is an unprecedented governance challenge.

GOVERNANCE CHALLENGES

The conclusions of the Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy highlighted the major problem of the drinking water supplying, namely „in the Community there are the continuous growth in demand for sufficient quantities of good quality water for all purposes". Good water quality based drinking water supply system can contribute effectively to securing the safe drinking water supply for the population.[18]

[15] Qi S.-Z. and F. Luo (2005.) 'Water environmental degradation of the Heihe River Basin in arid northwestern China'. Environmental Monitoring and Assessment. 108 (1-3), 205-215.
[16] Pagiola S. and G. Platais (2007.) Payments for Environmental Services: From Theory to Practice. Washington, DC: World bank.
[17] Gomez-Baggethun E. and M. Ruiz Perez (2011.) 'Economic valuation and the commodification of ecosystem services', Progress in Physical Geography, 35, 613-628.
[18] Berek Tamás – Dávidovits Zsuzsanna: Vízbiztonsági terv szerepe az ivóvízellátás biztonsági rendszerében, 2012. Hadmérnök.

The following governance characteristics seem to be requirements for an adequate handling of trade-offs between human water security and environmental water needs. I, try to reflect here basically on three approaches:

- integrated and adaptive risk governance,
- polycentric water governance and management and
- combination of different governance modes.

First, water governance systems need to adopt an integrated and adaptive risk governance to balance risks to be able to respond to emerging challenges and embrace complexities and uncertainties. A reframing towards a systemic perspective is essential to comprehend and communicate the importance of ecosystem integrity for human well-being. From a broader risk perspective a more systemic approach to water security implies a shift in the emphasis from dealing with individual risks in isolation towards increasing the resilience of a social-ecological system as a whole.[19]

Second, it is increasingly recognized that polycentricity is an essential characteristic of integrated and adaptive water governance and management systems.[20] By combining a distribution of authority and power with coordination by an overarching system of rules, polycentric systems balance bottom-up and top-down (multi-level) and lateral (inter-sectoral) pathways of influence.[21] They are assumed to have high performance with respect to integration across issues and scales and regarding adaptive capacity.[22] Integration across sectors, scales and issues is essential to overcome the current fragmentation in dealing with the four dimensions of water security.

Third, the combination of different governance modes – namely, markets, regulatory mechanisms, bureaucratic hierarchies and learning networks – is essential for the integration of the different logics characterizing approaches to water security and for a sustainable implementation of the ecosystem services concept. In bureaucratic hierarchies, regulatory processes are mainly based on formal institutions, governmental actors play the dominant role, and coordination is mainly achieved by top-down control. Markets are based on a combination of formal and informal institutions, non-state actors may participate, and coordination is mainly based on trust and cooperation. If bureaucratic hierarchies are dysfunctional since the rule of law is not respected and rent-seeking behavior of governmental actors prevails, network governance and strengthening the capacity of local communities to claim their rights and to call governmental officials to be accountable may be an essential element for improving governmental performance.

[19] Chapin III F.S., G.P. Kofinas and C. Folke (2009.) Principles of Ecosystem stewardship: Resilience-Based Natural Resource Management in a Changing World. New York: Springer.
[20] Ostrom E. (2001.) 'Vulnerability and polycentric governance systems', IHDP (International Human Dimensions Programme on Global Environmental Chane) Newsletter UPDATE, 3(1), 3-4.
[21] Ostrom E. (2010.) 'Polycentric systems for coping with collective action and global environmental change', Global Environmental Change, 20, 550-557.
[22] Blomquist W. and E. Schlager (2005.) 'Political pitfalls of integrated watershed management', Society and Natural Resources, 18, 101-117.

Such diversity in governance approaches is needed to be able to integrate different framings and to fully exploit the integrative potential of the ecosystem services concept. Ecosystem services describe the benefits derived for human well-being from terrestrial and aquatic ecosystems. They can thus translate the logic of ecosystem integrity into what is important for economic production and human well-being (livelihoods and qualify of life). Valuation must not be limited to monetary approaches.[23] Combinations of governance modes and approaches that integrate different dimensions of valuation can also overcome the frequently prevailing emphasis on monetary arguments, to include nature in the accounting scheme (although not necessarily using a financial metric). The ecosystem services approach can be an important communication tool to raise the awareness for the need to adopt a systemic and holistic approach.

CONCLUSION

Enhancing and sustaining human water security and recognizing the importance of respecting environmental water needs for doing so will remain a central challenge for water governance from regional to globe scales. If one extrapolates from past experience to the future, moving towards this goal will be associated with negative consequences for the environment. In the long term this will undermine the resilience of social-ecological systems and thus human as well as environmental water security. Increasing pressures on water security give little reason to expect that prevailing trends will be reversed without major transformations in water governance systems and management paradigms.

More attention needs to be devoted to incompatible framings between different governance domains and how a lack of communication and integration can be overcome. The ecosystem services concept could be a central notion and a boundary object to overcome fragmentation if embedded is appropriate governance structures and deliberation processes. The full potential of the ecosystem services in this respect will only unfold if it is not only interpreted in monetary terms. Acknowledging a wide range of ecosystem services is expected to raise awareness of the importance of ecosystem functions for the resilience of social-ecological systems, to support negotiations about trade-offs and help in developing strategies for adaptive implementation. Good governance is required to assure that maximizing short-term benefits is replaced by investing in long-term resilience and sustainable pathways towards water security for central human needs, ecosystem and economic production.

[23] Engel S. and M. Schaefer (2013.) 'Ecosystem services – a useful concept for addressing water challenges?', Current Opinion in Environmental Sustainability, 5 (6), 696-707.

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