

## Water Governance and Sustainable Development

C. Gregory KNIGHT and The World Water Team<sup>1</sup>

Department of Geography and School of International Affairs  
The Pennsylvania State University  
University Park, PA 16803 USA  
[cgk@psu.edu](mailto:cgk@psu.edu)

**Abstract:** Is fresh water a truly renewable resource? This paper argues that freshwater for human use is threatened by climate change, fossil water extraction and globalization processes that will exacerbate problems of access to potable water as a human right and challenge water governance on local, regional, national and global scales. Using concept maps to examine the structure of the world water system, we argue that an emerging global water crisis can only be addressed by understanding the multiple linkages that tie individuals, institutions and issues to paradigms of water management that threaten the sustainability of fresh water use. By deconstructing the global water crisis into interlocking systems of issues and influence, we identify core questions in maintaining water as a sustainable resource.

**Keyword:** water, sustainable development, governance

### Introduction

It is widely recognized that fresh surface water is a rare and precious resource in comparison to world stocks of salt water, deep and shallow groundwater, and ice. These larger oceanic water stocks can be exploited to create fresh water at a high energy cost for conversion, and a significant portion of groundwater use involves mining of fossil water that is not replenished at contemporary rates of extraction.

Freshwater is usually viewed as a renewable resource, but this is a misnomer. It is really a flow resource whose flux can be redirected for human use, but whose magnitude has increasingly been subject to significant human intervention. Modern mankind has indeed done the latter, with widespread regional land use change, for example, changing the volume and distribution of rainfall and evaporation (especially through consumptive, evaporative uses in irrigation and industry. Weather modification attempts rainfall enhancement. Human-induced climate change will almost certainly alter water regimes, and may already be doing so. Glaciers and winter snow accumulation vital as a warm-weather source of lowland water, water batteries in effect, are already being threatened by global warming. In addition, fresh water consumptively used, evaporated into the atmosphere as a consequence of use, diminishes water availability for downstream uses; some researchers even consider water pollution a form of consumptive use when pollution precludes productive uses downstream.

### Fresh Water Sustainability

Fresh water sustainability includes long-term maintenance of adequate volumes of fresh water and commitments of fresh water to vital human uses, including recognition of water's place in basket of fundamental goods and services that should be attainable by all humans as a right. Sustainability means we leave as many choices about fresh water to future generations as possible, making as few permanent, irretrievable commitments as possible. We see that sustainability is being challenged by allocation of water by socio-economic and technical processes to other competing uses before meeting basic needs, by diminished water supply through global climate change, and by reliance on sources of water that are themselves non-sustainable, most important of which is ground water mining.

In addition to issues of freshwater distribution and diversion for human use, issues of sustainable water use also include processes of globalization and water governance. By globalization we refer to a multiplicity of processes that make what would seemingly be local and regional challenges into worldwide networks of

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<sup>1</sup> C. Gregory Knight<sup>a</sup>, Melissa May<sup>b</sup>, Audrey Broucek<sup>b</sup>, Mary E. Paskewicz<sup>c</sup>, Chongming Wang<sup>d</sup>, Regina Sagoe<sup>d</sup>, Rachel Sayre<sup>e</sup>, R. Scott Hillkirk<sup>e</sup>, Amy Norris<sup>e</sup> and Kolby K. Nelson<sup>e</sup> (<sup>a</sup>Department of Geography and School of International Affairs, Pennsylvania State University, University Park, PA, USA; <sup>b</sup>School of Forest Resources, Pennsylvania State University; <sup>c</sup>Department of Civil Engineering, Pennsylvania State University; <sup>d</sup>Department of Geography, Pennsylvania State University; <sup>e</sup>School of International Affairs, Pennsylvania State University).

important and interrelated issues. By governance, we refer to the many kinds of intersecting human systems that define the nature of water as a resource, that determine water allocation among human uses, and that use social, political, economic and legal systems at multiple scales to control and enforce these precepts.

In this presentation, we report on-going research on the structure of the emerging global water crisis, using visualization of linkages between and among issues and entities to illustrate the emergence of threats to sustainable water use as a global, not merely local, problem. We argue that the nexus of water sustainability lies at the intersection of water availability in the physical sense and water governance.

## Concept Maps

In the presentation, we illustrate the basic elements of concept maps (Cmaps) as developed by the Institute for Human and Machine Cognition (2009). Concept maps consist of concepts and linkages, groups of which can be combined as nested nodes. Concepts and nodes can reference website links, document links, and links to other Cmaps. The Cmaps can be stored locally, included in websites or made available on servers. Cmaps are a visual, qualitative expression of information, subject to evaluation and criticism on the same basis as other visual and non-quantitative expressions of knowledge.

## The Global Water Crisis

Figure 1 illustrates the interconnection of elements in the global water crisis, details of which are explicated in the conference presentation. By cumulative change, we refer to changes that are local and regional in scope, but are replicated widely and significantly throughout the world. Soil erosion, deforestation and water pollution are examples. By systemic change, we mean alterations of the global system itself, including such phenomena as ozone depletion, climate change and sea level change (Turner et al. 1990). Sustainable fresh water is subject to both kinds of change. In particular, dimensions of significant cumulative water change include water shortages, cost, limited access, gender roles, hazards (floods, drought), dam building, and management (privatization of public water supplies). Water has systemic dimensions, which include the international finance and the water economy, global governance, global systems of technical knowledge, and global water action.

Other important elements of the Global Water Crisis are shown in Figure 1. Place attributes include but are not limited to the role of water in culture, history, religion, politics, ideology, law, and management. Water paradigms are ways in which water is conceived and allocated. Global actors and actions include international, national, non-governmental organizations, and individuals. Geographic scale is also an important dimension, including issues of water sharing across intra-national and international boundaries and interbasin transfers.

## Water Paradigms

Of all these dimensions and linkages creating a global water crisis, perhaps the paradigms with which water is viewed and acted upon is most important. Figure 2 differentiates among social, biological and economic perspectives on water. These somewhat complementary but more often competing paradigms recognize water as a biological need that is imbued with multiple social dimensions versus a fundamental question of water's economic value and the role of water's economic value in water allocation and use.

Who owns water? Should water be allocated solely by market means? Is there an obligation of society (government) to provide for basic water needs as a human right? If water is, in fact, most costly for the poor, shouldn't even the poor pay for formal water supply (public or corporate), which could be cheaper than the existing situation? What is the appropriate role of profit-making corporations vs. government? Is water planning excessively driven by technological mind-sets that view big dams, centralized piped supply systems and centralized control as obligatory? Are sewerage systems the only means to achieve sanitation? These are basic questions raised in consideration of how water is conceived or framed and how solutions to addressing water needs are sought.

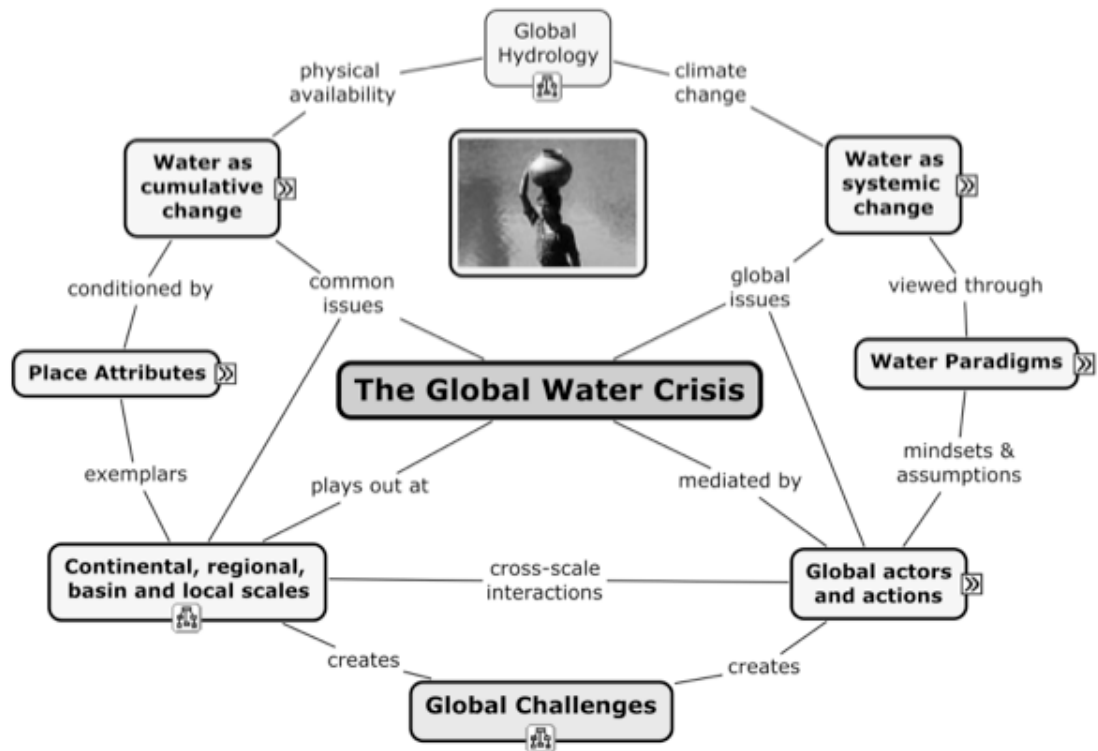


Figure 1: The Global Water Crisis. Copyright (c) 2009 by the World Water Team, used by permission.

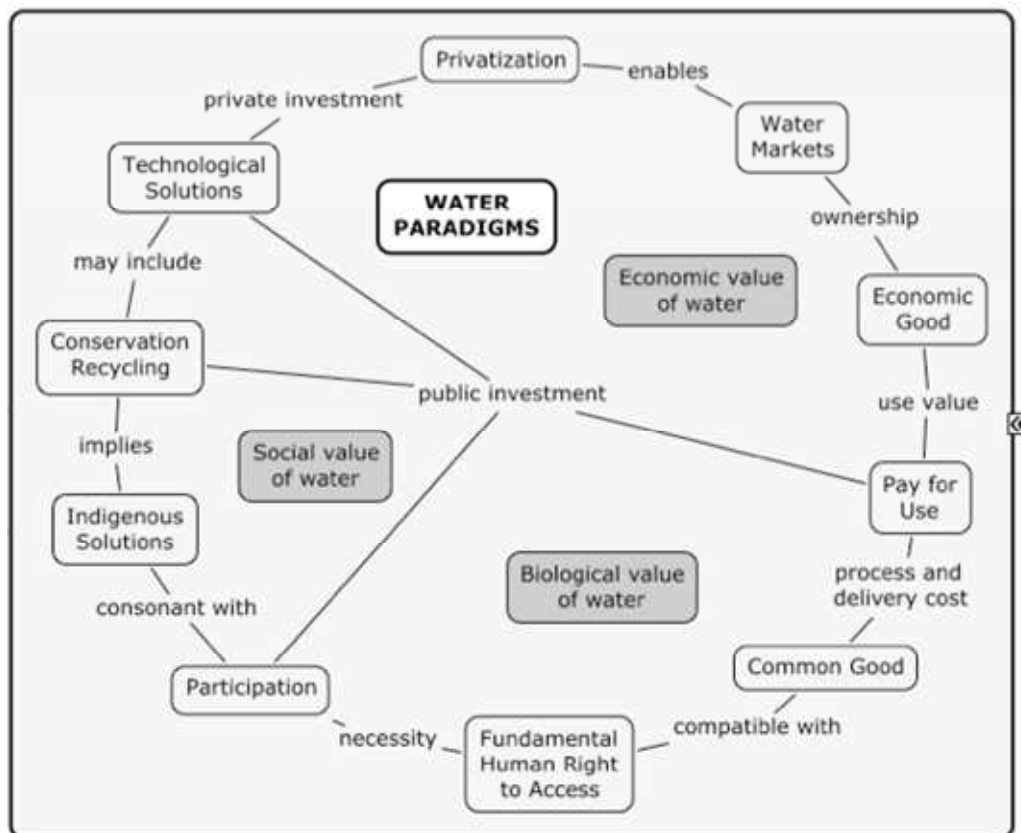
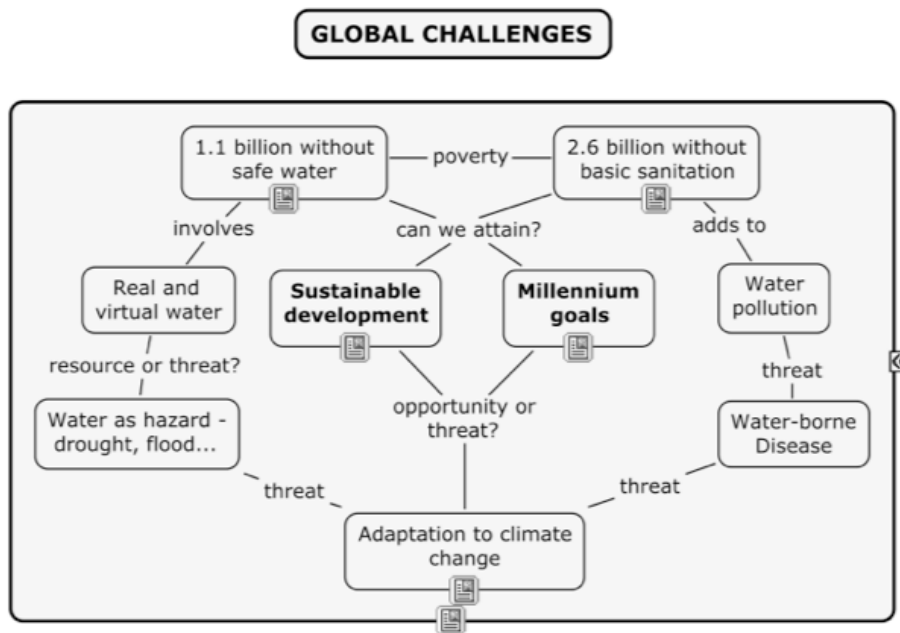


Figure 2: Paradigms in the Global Water Crisis. Copyright (c) 2009 by the World Water Team, used by permission.

## Global Challenges

Global challenges of fresh water supply relate both to the Millennium Development Goals and to the concepts of sustainable development (Figure 3). The United Nations Millennium Development Goals (2008) include “Target 3: □Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation.” We believe that issues of safe water and sanitation threaten the ways in which society can adapt to the long-term threat of climate change, and thence to achieving fresh water sustainability. The fourth report of the Intergovernmental Panel on Climate Change (2007) shows that the Mediterranean Basin may be one of the world regions most threatened by climate-change-induced aridity, so these issues are particularly salient for countries represented in this conference on sustainability being held in the Balkan Region. In its Technical Paper on climate change and water, the IPCC notes that “Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems” (Bates et al. 2008).



**Figure 3:** Global Challenges in the Global Water Crisis. Copyright (c) 2009 by the World Water Team, used by permission.

## Global Water Governance and Sustainability

How the challenges of climate change and sustainability are met may be largely determined by the system of global water governance (Figure 4). The loci of decisions about water policy and allocation will be focal in society’s ability to adapt to climate change and to achieve a sustainable system for fresh water utilization. Will corporate interests increasingly dominate water governance, as seems evident in organizations like the World Water Council and its World Water Forums, such as the 2009 gathering in Istanbul? In that conference, participants in writing the “Istanbul Ministerial Statement” could not agree that water is a human right, only concurring that water is a human need (Fifth World Water Forum 2009; Freshwater Action Network 2009). Does it take water ministers to endorse a reality that is known in every elementary classroom? Or will public interests dominate discourse about water futures, with emphasis on making good a promise of water and sanitation as a fundamental human right? Such issues are at the core of sustainable development.

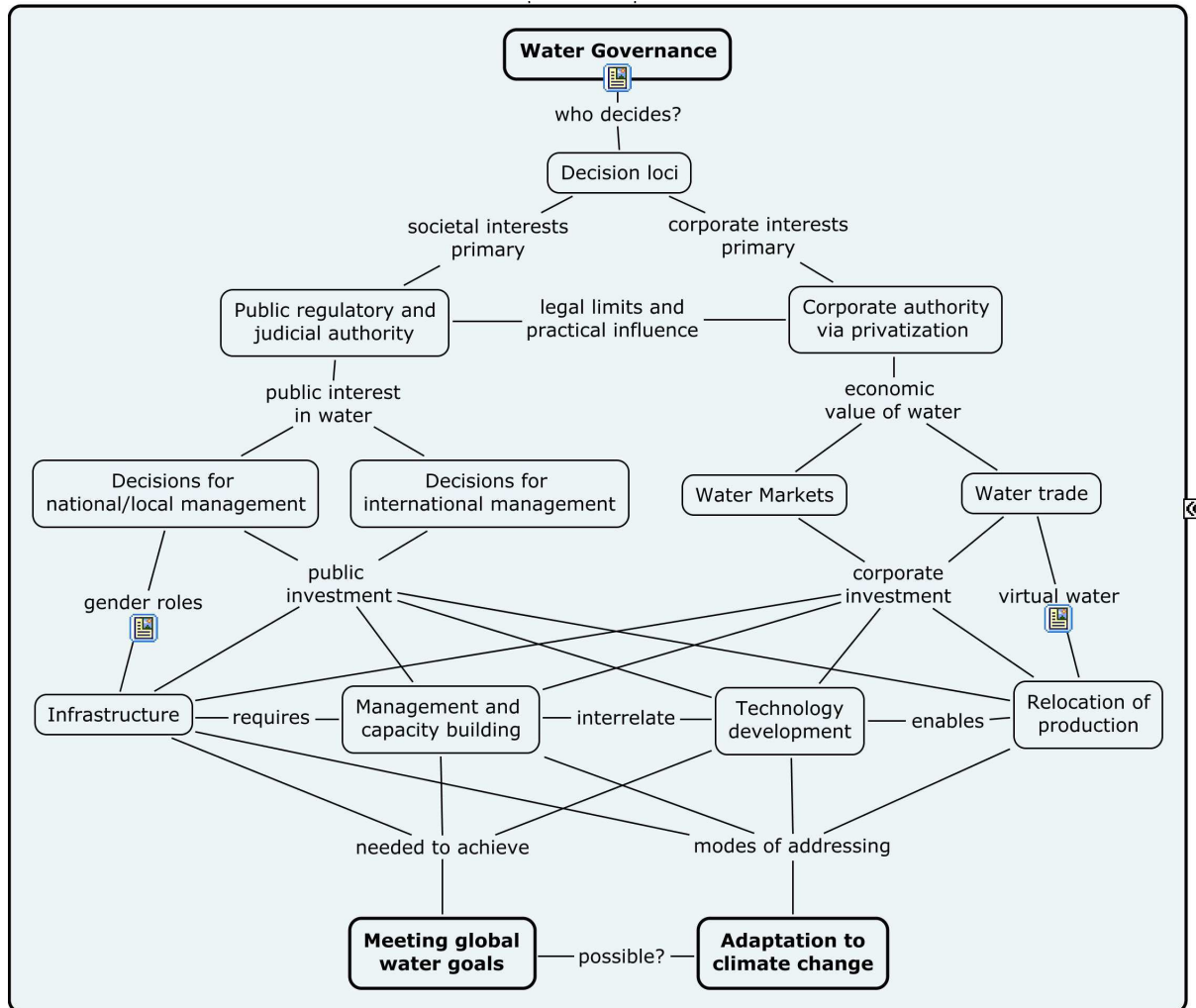


Figure 4: Global Water Governance. Copyright (c) 2009 by the World Water Team, used by permission.

## Conclusion

This brief paper and presentation can only begin to include all the nuances that concept mapping of global water issues includes. For example, we have not explored complex interrelationships among individuals, institutions and issues. We hope, nevertheless, to have established that the Global Water Crisis is a critical challenge to achieving the Millennium Development Goals and of achieving a vital component of Sustainable Development. At present there may be adequate fresh water supplies to meet basic human needs, but this is by no means guaranteed for the future, nor are socially and economically available water resources necessarily consonant in distribution with human populations. Water governance, an increasingly global issue, is at the core of fresh water availability and management and deserves increasing scrutiny and critical analysis. One simply cannot conceive of sustainable development without water being a core issue in its achievement.

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### **Acknowledgements**

The World Water Team, an informal collaboration initiated at the Pennsylvania State University (USA) appreciates the opportunity provided by the organizers of the International Symposium on Sustainable Development, 9-10 June 2009, at International Burch University, Sarajevo, Bosnia-Herzegovina, to present preliminary results of its examination of the global water system. Our graphics are a work in progress; permission is given to the ISSD to include them in its symposium publication and CD with the understanding that they may not be further copied nor published without written permission of the World Water Team (contact C. G. Knight, [cgk@psu.edu](mailto:cgk@psu.edu), on behalf of the Team). The Team welcomes comments. Views expressed are not necessarily those of the Pennsylvania State University.