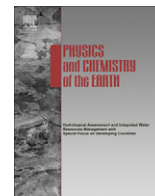




Contents lists available at ScienceDirect

Physics and Chemistry of the Earth

journal homepage: www.elsevier.com/locate/pceCharting the emergence of 'global water initiatives' in world water governance [☆]Robert G. Varady^{a,*}, Katharine Meehan^b, Emily McGovern^a^a University of Arizona, Udall Center for Studies in Public Policy, 803 E First St., Tucson, AZ 85719, United States^b Department of Geography and Regional Development, University of Arizona, United States

ARTICLE INFO

Article history:

Received 20 December 2007

Received in revised form 15 May 2008

Accepted 17 June 2008

Available online xxx

Keywords:

Global water governance

Institutions

Policy

Transboundary water

ABSTRACT

Over the last century, the aperture of water governance has widened beyond local and regional schemes to include a growing number of dynamic organizations and events with a “global” scope. Until recently, little had been written about the historical development of global water governance, institutional connectivity within the field, or key organizational successes and failures as perceived by water experts. This paper provides water scientists, managers, policymakers, and those with an interest in international water issues with an overview of global initiatives. It charts the emergence of a set of institutions and events, referred to as “global water initiatives,” or GWIs, using a survey of water experts and other research. Institutional diversity among GWIs is described by defining four distinct types of initiatives and specific differences in scope and programmatic orientation. This overview also entails the historical paradigms of water management, evaluation of the results of the growth and proliferation of numerous new GWIs in recent decades, and some recommendations for supporting and sustaining GWI efforts in order to foster and improve multilevel water management in the future.

© 2008 Elsevier Ltd. All rights reserved.

1. Introduction

The activities of water governance increasingly transcend international boundaries and are undertaken with an ever more comprehensive frame of reference. Complex challenges to water resources management, such as persistent drought, extreme flood events, deteriorating water quality, and species extinction have prompted decision-makers to seek solutions across political borders (Conca, 2006; Wolf et al., 2003). International cooperation for improved river management, for instance, has resulted in a multitude of treaties, compacts, and agreements – governing large international watersheds such as the Mekong and Danube River basins and small catchments such as the San Pedro River basin in the US–Mexico border region (Postel and Richter, 2003).

The aperture of water governance, however, has widened beyond regional schemes to include a growing number of organizations and events with a “global” scope. Such global-level efforts in the water sector have fed – and been fed by – a widening set of institutions and events, which we collectively call “global water initiatives,” or GWIs. GWIs, including prominent examples like the World Water Council and the Global Water Partnership, mark a significant if gradual shift in water governance: from a framework

in which the bulk of water-policy changes occur through relatively isolated endeavors with focused impacts on local management and environments, toward a decentralized framework of water management set within global-level principles and governance mechanisms. Reflecting similar trends toward global coordination in other sectors (such as human rights, the HIV/AIDS crisis, and global climate change),¹ this recent shift spotlights efforts to shape the contours of water knowledge, policy, and management through governance arrangements between and outside the state.

Within the literatures of international relations and political science, such arrangements are at the heart of “policy networks,” “issue networks,” “multilevel governance” and, for scholars of the environment, “environmental governance” (Betsill and Bulkeley, 2006; Haas, 1992; Karkkainen, 2004; Lemos and Agrawal, 2006). Lemos and Agrawal (2006, p. 3.2) use a definition of environmental governance as “the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes.” This definition includes but is not limited to the actions of the state; forms of environmental governance also take place via “[i]nternational accords, national policies and legislation, local decision-making structures, transnational institutions, and environmental NGOs...” (Lemos and Agrawal, 2006, p. 3.2). Similarly, global water governance is enacted in part through the interplay of global-level actors – such as GWIs – with those situated to do their daily work at other scales. We attempt to

^{*} This article was written for *Physics and Chemistry of the Earth* as a substantially expanded, revised, updated, and reframed discussion of global water initiatives, based on an essay by two of the authors (Varady and Meehan, 2006) that appeared in the October 2006 issue of *Water Resources IMPACT* (with permission).

^{*} Corresponding author. Tel.: +011 520 626 4393; fax: +011 520 626 3664.

E-mail address: rvarady@email.arizona.edu (R.G. Varady).

¹ For a thought-provoking discussion of the merits of using the Intergovernmental Panel on Climate Change as a model for global water coordination, see (Rodda, 2007).

elaborate the growing role of GWIs in order to lay the groundwork for a better understanding of this interplay and, thereby, the multilevel governance of water.

The need for global coordination of water management seems more urgent each day; but in practice, global efforts at water governance have met both praise and criticism. Conca (2006) describes troubling disjunctures between the most common mechanisms of global water governance – especially the transboundary-treaty/water-regime approach – and local water contexts. These disjunctures include the effects of uneven power relations among participants in global fora and international decision-making, as well as a frequent lack of fit between international treaty-making and the complicated, multi-scaled nature of actual water problems. But Conca (2006) also sees promise in new and emergent forms of global water governance, such as the transnational linkages formed in anti-dam activism that made substantial impacts on dam policies and resulted in the creation of an influential multi-stakeholder advisory committee. Other observers are disappointed by the shortcomings of the massive water “megaconferences” (such as the 2002 World Summit on Sustainable Development in Johannesburg and the triennial World Water Forums, held most recently in Mexico City in 2006), which have gained ascendancy in the global water-governance arena. Such dismay is voiced through critiques of the large gatherings’ enormous costs, unclear objectives, uneven stakeholder participation, weak declarations, and supposed lack of measurable outcomes. At the same time, these expansive conferences are also applauded for raising political and media awareness over water issues, and for providing critical venues to coordinate research and policy, consolidate knowledge of water science and management, and develop strategies for the future (Gleick and Lane, 2005; Seyfang, 2003).²

The noteworthy proliferation of GWIs in recent years (as described in more detail below) has prompted a common question: When do the activities and sheer number of GWIs result in a cacophony rather than a concord of institutional resources, time, and efforts? Such an evaluation would be incomplete without an understanding of the historical roots of GWIs and their contemporary role in water governance. Further, the critiques of certain features of global governance encourage us to look more closely at GWI activities, characteristics, and the factors that make them a compelling force in the evolving governance of the world’s water resources. Until recently, little had been written about the patterns of GWI development, their institutional connectivity, or their successes and failures as perceived by water experts (Varady, 2003; Varady and Iles-Shih, in press; Varady et al., 2008; also see Conca, 2006 for related discussion). This paper helps bridge that gap and provides water scientists, managers, policymakers, and those with an interest in global water issues with an overview of global initiatives. As such, the paper has three specific objectives:

- To posit a new ontology of water governance, by which we argue that the growth and proliferation of GWIs have resulted in institutional diversity and a transformation of the global water governance arena. In addition, we argue that these changes are productive in maintaining the long-term sustainability of this arena.
- To illustrate the historical progression through which particular GWIs and GWI networks have come to contribute to global governance, through a brief history of the major ideas and specific institutions key to their development.

- To offer recommendations for supporting and sustaining the efforts of GWIs in order to foster and improve multilevel water management.

2. A new ontology of global water initiatives

As suggested above, international treaties and megaconferences are two highly visible pieces of a much larger global water puzzle. Following the notion that governance includes governing processes both within and outside the formal state apparatus (i.e., Conca, 2006; Lemos and Agrawal, 2006), we conceptualize water governance to include the diverse yet distinct networks of global-level organizations, professional societies, and events that constitute GWIs. This ontological shift situates GWIs as key sites for decision-making, knowledge transfer, and conflict resolution – all core components of governance. In so doing, we suggest a conceptual framework of water governance that accounts for institutional diversity and organizational interconnectedness. The three elements of this ontology argue that:

- Water and its institutions have not always been “global,” but GWIs are increasingly prevalent and legitimate sites of water governance.
- Global water initiatives do not exist in isolation, but rather as part of a complex network.
- The GWI network contains at least four types of initiatives.

We broadly define GWIs to include the numerous institutional frameworks, organizations, and special events that focus on global water resources management. More specifically, our typology of GWIs includes: (1) *professional scientific societies* such as the International Association of Hydrological Sciences and the International Water Resources Association, (2) *designated time periods* such as the International Hydrological Decade and the International Water for Life Decade, (3) *organized events* such as the Dublin International Conference on Water and Environment and the four World Water Forums, and (4) *issue-oriented organizations* including the UN-affiliated, intergovernmental International Hydrological Programme, the nongovernmental Global Water Partnership, and the Netherlands-based Dialogue on Water and Climate.³

These four types of GWIs function as part of a decentralized network, in which the aims and activities of specific initiatives connect, disconnect, and overlap at many points. GWIs represent a constellation of topics, specialties, and knowledge, thereby drawing upon knowledge-building epistemic communities to inform policy prescriptions.⁴ Viewed collectively, GWIs make important contributions toward advancing the global framework of water management as well as inspiring and supporting improvements in specific basins.

Though immediate and local impacts of GWI activities are rarely clear or easily measurable (see Varady et al., 2008), the connections are real. Products of specific GWIs include the coordination of research, policy, and funding – often at regional and basin

³ The typology includes the four types of initiative that are most prominent in the development of the global water issue network. Other institutions may be relevant to the work of these GWIs, but in the authors’ view play a secondary role, often as subsidiary activities of GWIs, and are, therefore, not included in the typology. An example is the existence of house journals within professional societies. These may be best categorized as products of those particular organizations.

⁴ After Haas (1992), we define epistemic communities as “networks of knowledge-based experts” that help to articulate complex natural resources and other problems, increasingly within the international sphere, and that have recognized expertise in establishing policy-relevant knowledge within an issue area. Conca (2006) further explores the role of epistemic communities and knowledge construction in international water regimes.

² For further discussion of megaconferences as a central – and controversial – feature of global water governance, see (Biswas, 2001; Gleick and Lane, 2005; Speth, 2003; Varady et al., 2006, 2008).

levels; the support of in-house journals; the declarations by membership and participants at international forums; education of membership; and communication of primary messages through mass media outlets. As such, these initiatives strive to shape governance of water not just at a global or international level, but also seek to influence action based within the region and across individual basins. While we attempt to provide concrete examples of GWI activities, our analysis remains deliberately broad to capture the wide scope of the GWI field.

An example of GWI governance-in-action is the production and dissemination of “Integrated Water Resources Management” (known as IWRM): a comprehensive and interdisciplinary process to manage water resources in a way that balances social, economic, and ecological needs. The Global Water Partnership (GWP) has particularly supported IWRM approaches through its network of 12 Regional Water Partnerships and 71 Country Water Partnerships and through wide distribution of guidance materials (GWP Joint Donor External Evaluation, 2008). GWP works with its partners to identify gaps, critical needs, available resources and potential action in support of sustainable – and place-specific – water management (Gayfer et al., 2008, p. 7). It attempts to measure achievements at country and regional levels through, for example, the integration of IWRM into national development plans and local river basin plans and processes (Gayfer et al., 2008, p. 17).

Such activities help to bring IWRM guidance documents – largely hashed out at GWI organizations, at large international water meetings, and in the water policy journals – to participants from individual water contexts (who may or may not have access to these other fora). This may be another example of the type of multilevel governance described by Betsill and Bulkeley (2006, pp. 144, 151–2) in their analysis of research and policy networks on global climate change. In a multilevel governance framework, multiple modes of governing interact across spaces based on diverse spheres of authority (which cannot necessarily be read hierarchically).

3. A history of global water

Next, we demonstrate that the global purview of contemporary water governance is a historical product of rich veins of organizational affiliations, collaborations, and changing paradigms in water management.

3.1. The shifting stage of ideas

A historical analysis of water governance shows that water was not always perceived, addressed, studied, inventoried, or managed as a “global” resource. Instead, the dominant concepts of water management became “globalized” (i.e., came more often to incorporate global actors, global thinking, and action across international boundaries) over time. This perceptual transformation is in part traceable through the sequential adoption of new paradigms of water governance, each reflecting then-current modes of thinking. Fig. 1 conceptualizes the iterative and overlapping progression of different management frameworks. For example, in the early 20th century, state-led development projects and centralized institutions were the norm. Rational-actor models of environmental behavior, economics, and decision-making rose to prominence under the influence of the “Chicago School” of free market economic theory.⁵ The late 1970s were marked by a radical shift toward models of neoliberal governance, featuring policies such as structural-

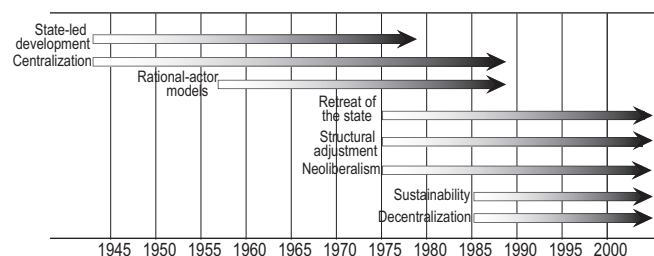


Fig. 1. Evolution of dominant paradigms in water governance.

adjustment programs and sharp decreases in state spending. This period was followed by a rise in the nongovernmental organization (NGO) sector. Sustainable development, public participation, transparency, and decentralization – concepts often taken for granted in contemporary water policy – are relatively new governance paradigms, arising in the late 1980s. These recent approaches have featured integrated management of water resources, which scientists and managers have increasingly come to associate with natural, rather than political, boundaries.

Interacting with these ideas over time, GWIs have collectively helped set global research and implementation agendas, strengthened international collaborations, and legitimized certain forms of water governance. Current paradigms show a relative concordance around governance of a particular type – one that emphasizes openness, stakeholder involvement, and sustainable management strategies (such as IWRM; Milich and Varady, 1999), that draws on expert epistemic communities, and is transnational in scope and largely nongovernmental or quasi-governmental in composition. In what follows, rather than pinpoint the specific causes of individual GWI development, we position the initiatives in historical and institutional contexts to spotlight their social production.

3.2. The development of institutions

Global water institutions, through organizational networks and encounters, have played critical roles in transforming and legitimizing water governance paradigms throughout history. But where and when did GWIs, as we conceive of them today, originate? Here, a short history of key organizations, professional societies, and megaconferences reveals a palpable trend toward institutional proliferation in an increasingly complex network.

The earliest efforts at formal organization were professional meetings, such as the first International Sanitary Conference, held in Paris in 1851. Two years later, Brussels, Belgium, was the site of the first International Meteorological Conference, and like events were held over the next decades (Rodda, 1995). Similar meetings during the 1880s gave rise to societies like the International Navigation Association. Such groups formed among professionals of various stripes to construct common intellectual spaces, share expertise, and stimulate and promote research.

By the mid-1950s, water scientists, engineers, and managers had established respected, well-subscribed organizations, each pursuing its members' interests; no fewer than a dozen important professional water societies currently function (Varady, 2003). Prominent examples include the International Association of Hydrological Sciences (IAHS; established in 1922), the International Association for Hydraulic Research (IAHR; established in 1935), and the International Water Resources Association (IWRA; established in 1972).

Professional societies have continued to play a key role in translating the global water cycle into diffuse realms of scientific knowledge. But they initially did little to elevate general awareness of the value of water. Public consciousness arose after the Second World

⁵ The Chicago School arose during the mid-20th century among University of Chicago economists and like-minded scholars, and is known for its promotion of neoclassical and free market theories in economics. Their influence on water markets, law, and policy has been especially prominent in Chile (see Bauer, 2004).

War, whose end engendered strong multinational approaches to avoiding new wars. Recognizing that many of the world's problems transcend borders, the newly-created United Nations (UN) advocated broad multilateralism and acknowledged that the roots of military conflict could be addressed only by improving human conditions.

The convergence of these principles – concerted multilateralism and an integrated view of the causes of conflict – spawned the establishment of a family of UN agencies to tackle health, nutrition, education and science, economics, and human rights. During the 1950s and 1960s, these agencies spearheaded the earliest global resources initiatives, such as two pioneering and influential designated time periods: the International Geophysical Year (1957–58), and the International Hydrological Decade (1965–74) – which at its conclusion morphed into the International Hydrological Programme, housed at the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The postwar period was a time of boundless confidence in the ability of science and technology to transform society and adapt the landscape to human needs. Nowhere was this new impulse more manifest than in the realm of water. The era was marked by ambitious, large-scale waterworks such as dams, barrages, irrigation schemes, and hydroelectric plants; river diversions and interbasin transfers; and wetlands-drainage and land-reclamation projects (Reisner, 1986; Worster, 1985). Heralded as signals of 20th century progress, these enterprises underlined the centrality of water to society.

For more than a decade, the International Hydrological Programme was the main water-related organization (not including professional societies) with a genuinely global purview. The late 1980s witnessed a rapid increase in the number of such organizations, a trend that accelerated further in the 1990s and early 2000s (see Fig. 2). Among the groups born during that time were the World Water Council, the Global Water Partnership, the World Water Assessment Programme, and the HELP (Hydrology for the Environment, Life and Policy) Initiative, to name just a few. Many of these groups have become leaders in promoting current concepts in water management, such as decentralization, public participation, and institutional cooperation at the global level.

Notwithstanding the worthy aims of GWIs, the pressing question of proliferation remains: Are there too many global water initiatives today? To address this, in the next section we draw on results of a 2003–2004 survey of water experts to show that, while GWI proliferation and overlap are seen as negative, efforts to “streamline” initiatives are most often seen as an inappropriate response to these conditions (Varady and Iles-Shih, in press).

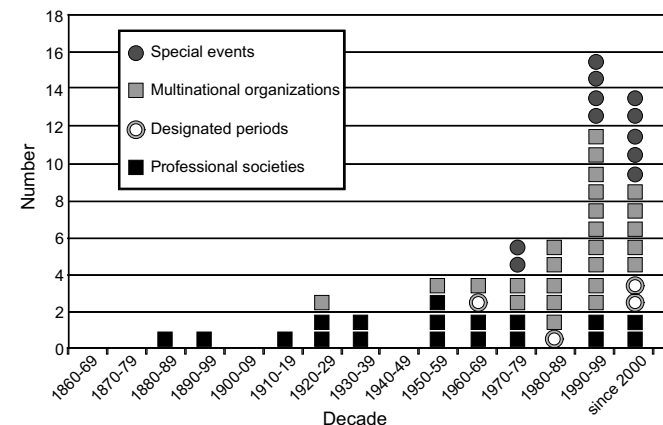


Fig. 2. Emergence of new GWIs by decade and type.

4. The importance of networks and institutional diversity

Given the burst of new GWIs across sectors and regions, it is helpful to draw on the concept of “institutional diversity” to understand the “value-added” benefit GWIs may offer.

Social scientists show that adding to the *diversity* of institutions participating in a network can be a highly productive way to *sustain* that network. Collectively, institutions set global agendas, legitimize certain forms of governance, and strengthen international collaborations (Seyfang, 2003). Common elements of institutional sustainability include the presence of norms, laws, procedures, frameworks, policymaking processes, and organizations that induce stability and resilience, thus permitting institutions to transcend personal politics, withstand opposition, and preserve legitimacy and authority over the long-term (see, e.g., Lewis, 2003).

Thus, rather than seeing the proliferation of new GWIs as a necessarily or entirely negative development, it is useful to view the field in terms of institutional diversity and sustainability. This view suggests that, since managing the world's water is a large and complex task, the effort may benefit from the participation of an array of institutions, with different “niches,” to successfully address it. Yet, in empirical and practical terms, the proliferation dilemma remains: When do the activities and sheer number of GWIs result in a cacophony rather than a concord of institutional resources, time, and efforts?

4.1. Surveying the institutional landscape

To address the above question, we draw on data from a 2003–2004 survey of global water experts (Varady and Iles-Shih, in press). Robert Varady conducted this inquiry in the course of a sabbatical year at UNESCO's International Hydrological Programme in Paris, France. First, he collected primary and secondary written sources on the origins of dozens of discreet initiatives, their objectives, leaders, and workings. From this information and from 38 in-depth interviews with knowledgeable individuals was constructed a contextual framework for the evolution and significance of global water initiatives. Concurrently, to help answer key questions on the genesis, operation, and influence of the most significant initiatives, and to better understand the nature of their interactions, Varady surveyed 117 influential GWI participants and knowledgeable individuals, including officials at nearly 40 international water-related institutions. Participants were purposively sampled on the criteria of their involvement (either in leadership positions within relevant organizations or as longstanding observers) and expertise in international water management. The organizations with which participants were affiliated include non-governmental organizations, intergovernmental agencies (all part of the UN system), and professional associations.

Overall, the results indicate that while institutional overlap and proliferation are viewed unfavorably, efforts to “streamline” the ensemble of GWIs are overwhelmingly discouraged (Varady and Iles-Shih, in press). For example, 75% of survey respondents thought institutional overlap – defined as the duplication of institutional objectives and efforts – was prevalent in global water governance (50 experts responded to questions on overlap and proliferation). Half of respondents who rated GWIs considered overlap to be a significant occurrence, and 58% characterized overlap as a negative characteristic. Regarding GWI proliferation – i.e., institutional propagation – 56% of respondents thought proliferation was significant. Attitudes toward proliferation were more negative (64%) than toward overlap (58%).

These results reflect a particular impression of the institutional landscape: GWIs have boomed in the spaces of global-level governance, but not without instances of replication, crowding, and competition. Despite views from water experts that overlap and

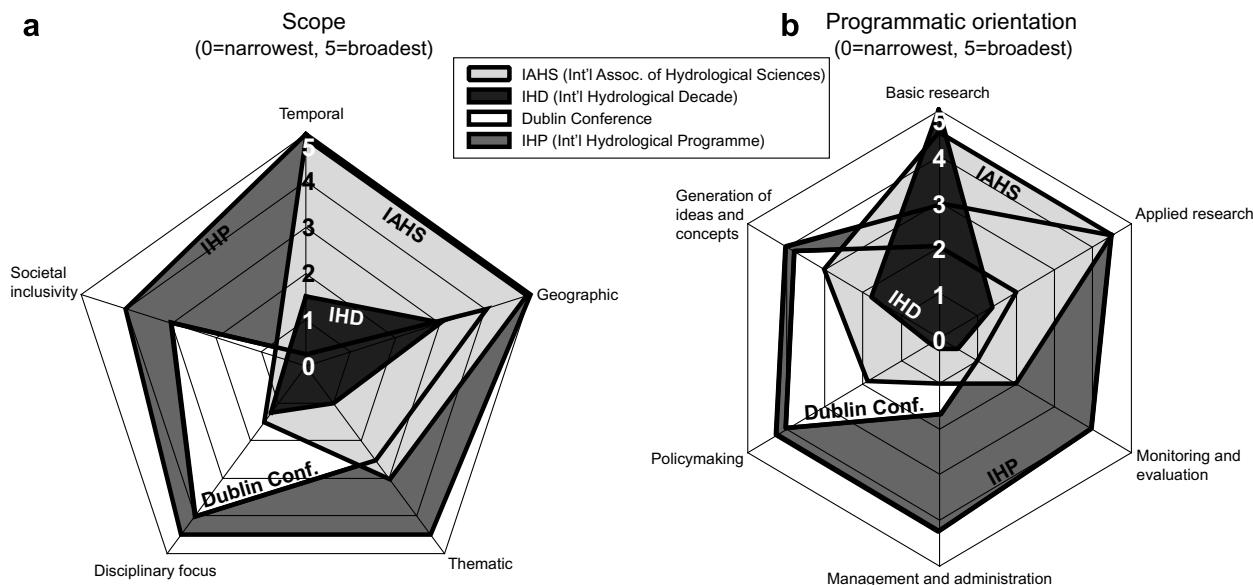


Fig. 3. Profiles of influential initiatives: (a) scope and (b) programmatic orientation.

proliferation are negative attributes, 82% preferred guiding these trends instead of stopping or limiting them. In other words, a flood of GWIs may exist in the global sector, but experts resoundingly reject efforts to police proliferation or streamline overlap. Alternatives, such as flexible management or improved avenues of communication, were suggested instead (Varady et al., 2008). The interpretation of these results may be tempered by acknowledging the potential role of self-interest on the part of respondents, who would presumably prefer increasing opportunities in their field and organizations rather than reducing them. Nonetheless, the results also shed light on the particular vision of the future of GWIs held by their participants.

These empirical insights provide a much-needed context to understand the evolution of global water management. GWIs, for all their faults, are seen by participants in the field as a wellspring of institutional diversity: the rich patchwork of rules, norms, objectives, individuals, and collective efforts to manage water. The unfolding of GWIs in the global arena has not come without problems, yet the institutional diversity of the GWI field may prove to strengthen governance. In this view, improvements in governance can arise not only via increased opportunities to voice concerns in international forums (megaconferences), but also through sustaining connections and creating new collaborations among organizations and individuals. Such a process keeps global agendas open to fresh ideas and goals, and to legitimizing governance in a democratic, albeit hectic, setting.

4.2. Visualizing institutional diversity

The degree of institutional diversity can in part be characterized through the balance achieved among the four types of GWI described above. Another, organization-specific way is to visualize the relative scope and content of various GWIs through the use of conceptual Likert-scale polygon diagrams (Fig. 3). This graphical technique, in which analysts assign scaled values along different axes representing institutional characteristics, can serve as a kind of “fingerprinting” instrument. The diagrams, in which multiple institutions – in this case, GWIs – appear within the same polygon, reveal that each GWI exhibits a unique profile.

The two diagrams above were developed by Varady and Iles-Shih to supplement their survey work (Varady and Iles-Shih, in

press). The ratings are relative and subjective, based on detailed interviews, first-hand observation within institutions, and archival research. They help visualize actual observations about the four GWIs included. And while some of the values assigned would likely change from one observer to the next, the diagrams nonetheless illustrate the concept of institutional diversity. By highlighting the distinctiveness of each initiative and the resulting diversity, these diagrams capture qualitative observations about the overall GWI field. In particular, they help explain the impetus for the creation of new institutions, which has occurred with increasing frequency in recent decades. As well, they illustrate that overlap is never complete, but only partial.

In the first polygon (Fig. 3a), Varady and Iles-Shih applied a scale of 0–5 (from narrowest to broadest) to five measures of an initiative’s scope (temporal, geographic, thematic, disciplinary focus, and societal inclusivity). Here, we have chosen four GWIs, selected because of their prominence and because they exemplify the four ontological types of institutions identified in Section 2, above. The initiatives thus treated are the International Association of Hydrological Sciences (IAHS), the International Hydrological Decade (IHD), the Dublin Conference of 1992, and the International Hydrological Programme (IHP); these correspond to the typology discussed in Section 2, above. If the universe of such institutions were mapped in this fashion, each initiative would be identifiable by its polygon signature.

In the second diagram (Fig. 3b), the same four initiatives are visualized in terms of their very different programmatic orientations (basic research, applied research, monitoring and evaluation, management and administration, policymaking, and idea-generation). As in Fig. 3a, the institutional signatures show marked disparity and suggest a degree of complementarity. Clearly among GWIs there is diversity as well as overlap, and both may be capitalized upon as productive attributes of the water policy and governance networks to which they belong.

5. Conclusion: strengthening networks and achieving sustainability in global water governance

How can charting the development of GWIs, as historically-situated, networked efforts, with a diversity of forms and approaches as well as shared management paradigms, inform water policy and

management? Without understanding the networks, we are less informed on how global water policy and management are built. On one level, the history of GWIs prompts us to fundamentally reconsider the “global” spaces of water governance. Global efforts to influence governance are in fact constituted through increasingly important but very particular venues, places, and networks. Global governance is not characterized by an even or smooth distribution of power, decision-making, or policy across space. Rather, global water governance occurs – increasingly via GWI channels – in specific places (e.g., Paris, Stockholm, or Tokyo), through particular networks of knowledge transfer and communication (e.g., the referee system of water journals; and recognized educational centers such as UNESCO’s Institute for Water Education), and in specific venues (e.g., the cafeterias and corridors of the World Water Forums).

That these various endeavors are connected by active affiliations through contingent and decentralized networks, rather than via formal, predetermined linkages, emphasizes their real potential to be shaped in productive ways. Viewing GWIs, such as megaconferences, as self-contained and definitive events misses the point. The more fruitful question is not “Are megaconferences good or bad?” but “How do we keep the networks of GWIs and global governance productive and sustainable?” In other words, achieving sustainability in governance is intimately linked to the health of networks.

This reframing holds important considerations for policy at multiple levels. For example, many programs that support “institutional development” tend to concentrate their efforts on strengthening individual institutions (often through funding or training) without making allowances for their ties (or lack of ties) to related institutions. Some GWIs – such as the Global Water Partnership, the HELP Initiative, and FRIEND (Flow Regimes from International Experimental Network and Data Sets) – offer excellent illustration of how such networks can connect scientists, managers, and stakeholders in widely dispersed basins across the globe.

By understanding GWIs as a set of interrelated organizations, institutions, and experts, policy and programmatic support can be more readily directed at strengthening and sustaining appropriate networks. For example, building new avenues of communication and information-sharing (such as Internet portals), conducting a cross-sector evaluation of overlapping GWI programs, and integrating the work of GWIs within donor agendas are all effective ways to improve global water governance.⁶

Ultimately, determining how best to achieve sustainability in multilevel water governance starts with a fundamental shift in the ontology of water governance: seeing GWIs as situated and operating within vital networks. Examining the historical trajectories of GWI development and visualizing their roles within the broader network may help to home in on the linkages, gaps and future productive synergies within this vital network. Maximizing the effectiveness of GWIs in water governance requires strengthening and enhancing the resilience of this set of interconnected

institutions. Part of this process takes place organically in the busy hallways of international water conferences; some must be deliberate, through dissemination in publications, from awareness-raising periods such as the current International Water for Life Decade, and via new collaboration strategies such as those we have suggested above. The ensemble holds promise for laying the groundwork for sustainable global water governance.

References

- Bauer, C., 2004. *Siren Song: Chilean Water Law as a Model for International Reform*. Resources for the Future, Washington, DC.
- Betsill, M.M., Bulkeley, H., 2006. Cities and the multilevel governance of global climate change. *Global Governance* 12 (2), 141–159.
- Biswas, A., 2001. World Water Forum: in retrospect. *Water Policy* 3, 351–356.
- Conca, K., 2006. *Governing Water: Contentious Transnational Politics and Global Institution Building*. The MIT Press, Cambridge, MA.
- Gayfer, J., Hawkesworth, N., Hoare, R., Pierce, J., Sann, K., Van Woersem, B., 2008. Global Water Partnership Joint Donor External Evaluation, Final Report. 26 March 2008. Performance Assessment Resource Center, Sheffield, UK. Accessed April 8, 2008. Available at: <<http://www.gwpforum.org>>.
- Gleick, P.H., Lane, J., 2005. Large international water meetings: time for a reappraisal. *Water International* 30 (3), 410–414.
- Haas, P., 1992. Introduction: epistemic communities and international policy coordination. *International Organization* 46 (1), 1–35.
- Karkkainen, B., 2004. Post-sovereign environmental governance. *Global Environmental Politics* 4 (1), 72–96.
- Lemos, M.C., Agrawal, A., 2006. Environmental governance. *Annual Review of Environmental Resources* 31, 3.1–3.29.
- Lewis, D., 2003. NGOs, organizational culture, and institutional sustainability. *The Annals of the American Academy of Political and Social Science* 590 (1), 212–226.
- Milich, L., Varady, R.G., 1999. Openness, sustainability, and public participation: new designs for transboundary river-basin institutions. *Journal of Environment and Development* 8 (3), 258–306.
- Postel, S., Richter, B., 2003. *Rivers for Life: Managing Water for People and Nature*. Island Press, Washington, DC.
- Reisner, M., 1986. *Cadillac Desert: The American West and its Disappearing Water*. Viking, New York.
- Rodda, J.C., 1995. Whither world water? *Water Resources Bulletin* 31, 1–7.
- Rodda, J.C., 2007. Refreshing world water affairs. *Water Policy* 9 (6), 645–648.
- Seyfang, G., 2003. Environmental mega-conferences – from Stockholm to Johannesburg and beyond. *Global Environmental Change* 13 (3), 223–228.
- Speth, J.G., 2003. Perspectives on the Johannesburg summit. *Environment* 45 (1), 25–29.
- Varady, R.G. 2003. Global water initiatives: some preliminary observations on their evolution and significance. In: *Proceedings of the 3rd Conference of International Water History Association*. Alexandria, Egypt.
- Varady, R.G., Iles-Shih, M., in press. Global water initiatives: what do the experts think? Report on a survey of leading figures in the ‘World of Water.’ In: Biswas, A.K. (Ed.), *Impacts of Mega-Conferences on Global Water Development and Management*. Springer Verlag, pp. 15–68.
- Varady, R.G., Meehan, K., 2006. A flood of institutions? Sustaining global water initiatives. *Water Resources IMPACT* 8 (6), 19–22.
- Varady, R.G., Meehan, K., Rodda, J., McGovern, E., Iles-Shih, M., 2008. Strengthening global water governance. *Environment* 52 (2), 19–31.
- Varady, R.G., Wilder, M., Eden, S., Browning-Aiken, A., Jacobs, K., Valdes, J., 2006. ‘Mega-networking’ at the fourth World Water Forum in Mexico city: looking for opportunities at a megaconference. “Guest View” in *Arizona Water Resource* 14, 5.
- Wolf, A.T., Yoffe, S.B., Giordano, M., 2003. International waters: identifying basins at risk. *Water Policy* 5 (1), 29–60.
- Worster, D., 1985. *Rivers of Empire: Water, Aridity, and the Growth of the American West*. Pantheon Books, New York, NY.

⁶ For a more detailed discussion of policy recommendations for strengthening global water governance, please see (Varady et al., 2008).