



Hydropower and sustainability: Resilience and vulnerability in China's powersheds

Amy McNally^{a,*}, Darrin Magee^b, Aaron T. Wolf^c

^a Water Resource Graduate Program, Oregon State University, Corvallis, OR, USA

^b Environmental Studies Program, Hobart & William Smith Colleges, Geneva, NY, USA

^c Department of Geosciences, Oregon State University, Corvallis, OR, USA

ARTICLE INFO

Article history:

Received 15 November 2007

Received in revised form 18 March 2008

Accepted 30 July 2008

Available online 13 November 2008

Keywords:

Sustainability

Resilience

China

Dams

Vulnerability

Geopolitics

Powershed

Hydropower

Lancang River

Mekong River

Salween River

Nu River

ABSTRACT

Large dams represent a whole complex of social, economic and ecological processes, perhaps more than any other large infrastructure project. Today, countries with rapidly developing economies are constructing new dams to provide energy and flood control to growing populations in riparian and distant urban communities. If the system is lacking institutional capacity to absorb these physical and institutional changes there is potential for conflict, thereby threatening human security. In this paper, we propose analyzing sustainability (political, socioeconomic, and ecological) in terms of resilience versus vulnerability, framed within the spatial abstraction of a powershed. The powershed framework facilitates multi-scalar and transboundary analysis while remaining focused on the questions of resilience and vulnerability relating to hydropower dams.

Focusing on examples from China, this paper describes the complex nature of dams using the sustainability and powershed frameworks. We then analyze the roles of institutions in China to understand the relationships between power, human security and the socio-ecological system. To inform the study of conflicts over dams China is a particularly useful case study because we can examine what happens at the international, national and local scales. The powershed perspective allows us to examine resilience and vulnerability across political boundaries from a dynamic, process-defined analytical scale while remaining focused on a host of questions relating to hydro-development that invoke drivers and impacts on national and sub-national scales. The ability to disaggregate the affects of hydropower dam construction from political boundaries allows for a deeper analysis of resilience and vulnerability.

From our analysis we find that reforms in China's hydropower sector since 1996 have been motivated by the need to create stability at the national scale rather than resilient solutions to China's growing demand for energy and water resource control at the local and international scales. Some measures that improved economic development through the market economy and a combination of dam construction and institutional reform may indeed improve hydro-political resilience at a single scale. However, if China does address large-scale hydropower construction's potential to create multi-scale geopolitical tensions, they may be vulnerable to conflict – though not necessarily violent – in domestic and international political arenas. We conclude with a look toward a resilient basin institution for the Nu/Salween River, the site of a proposed large-scale hydropower development effort in China and Myanmar.

© 2008 Elsevier Ltd. All rights reserved.

1. Introduction

Large dams, perhaps more than any other large infrastructure project, represent a whole complex of social, economic and ecological processes. Today, countries with rapidly developing economies are constructing new dams to provide energy and flood

control to growing populations in riparian and distant urban communities. Meanwhile, countries that have a long history of dam construction are increasingly looking toward dam decommissioning because of changing environmental values and the economic cost of maintaining aging structures.

In the planning phase of dam development the disciplines of ecology, engineering and economics provide technical know-how to water resource developers. Furthermore, an extensive literature exists within the biophysical sciences and social sciences that identifies and evaluates the impacts of dams (Goldsmith and

* Corresponding author.

E-mail address: mcnally@geog.ucsb.edu (A. McNally).

Hildyard, 1986; McCully, 2001; Scudder, 2005) (see also Tilt et al., *this issue*). However, when exploring socio-ecological systems it is imperative to acknowledge the connection between the landscape and thousands of years of human history in order to place the economic and environmental costs and benefits into context. Physical water control structures that provide energy and water security are often paired with governmental mandates, court decisions and laws governing their construction, ownership, and operation, as well as the distribution of benefits derived from the structures. In both the United States and China, the political and physical means of managing water are rendered highly inflexible by bureaucratic inefficiencies and advantaged interest groups. As Goldsmith and Hildyard noted two decades ago, “no dam is built in a political vacuum” (Goldsmith and Hildyard, 1986, p. 241). Geopolitical discourse that integrates scientific knowledge with political, social and ethical insight provides a way to more fully understand the system in hopes of promoting sustainable and equitable practices at all scales.

Drivers and impacts (both positive and negative) of dam development often lie outside the immediate watershed of the dam, which suggests the utility of a conceptual framework not necessarily aligned with watershed boundaries or neat and arbitrary political demarcations. Magee (2006b) offers the framework of a “powershed” to encompass the regions that politically and economically benefit from the energy produced, as well as to assess the basin that is being socio-ecologically impacted. This framework refocuses our analysis from the physical structure of the dam to the relations between actors being affected by them, i.e. the politics of cooperation and conflict.

In the last 30 years, attention to “hydropolitics” (Waterbury, 1979) surrounding freshwater resources has led to recent debates about the likelihood of violent conflict in the form of water wars (Dupont, 2001; Postel and Wolf, 2001; Shiva, 2002; Swain, 2001; Tose et al., 2000). Yet an evaluation of indicators of international water conflict conducted by Wolf et al. (2003) suggests that dams, as a single variable, are only weakly linked to water disputes. Dams or diversions on international transboundary rivers in the absence of socio-political agreements, though, did in fact create settings conducive to conflict. While empirical studies are still wanting at other scales (e.g., provinces, regions, states, powersheds), we suspect that positive political relations and institutional agreements among political entities decrease the likelihood of conflicts surrounding dams whose influence, economically and biophysically, crosses political boundaries within nations.

In the first section of this paper we describe the complex nature of dams using the sustainability and powershed frameworks to holistically address geographical and political transboundary issues associated with dam development. We operationalize sustainability – both of institutions and ecological systems – along a continuum of resilience versus vulnerability. Employing a case study from China, the second section analyses the roles of institutions in China to understand the relationships between power, human security and socio-ecological systems in order to inform the study of conflicts over dams. The transboundary Mekong and Nu Rivers exemplify the need to transcend traditional political scalar boundaries in order to successfully identify and understand the role that hydropower development plays in the localized socio-ecological impacts of dam construction, the regional, asymmetric distribution of hydropower benefits, and international cooperation or conflict. While the complexity of hydropower development on China’s transboundary rivers is not necessarily unique, the fact that those rivers pass through as many as half a dozen countries underscores the need for a novel lens with which to examine the socio-ecological and political impacts of China’s hydropower development across political boundaries.

2. Conceptual and analytical frameworks

2.1. Hydro-political resilience and vulnerability

Within the framework of sustainability, concepts of “resilience” and “vulnerability” relate to the ability of biophysical systems to adapt to change (e.g., Gunderson and Pritchard, 2002). As the sustainability discourse has broadened to include human systems in recent years, research has also been increasingly geared toward identifying indicators of resilience and vulnerability within this broader context (e.g., Bolte et al., 2004; Lonergan et al., 2000; Turner et al., 2003). Simultaneously, dialog on “security” has migrated from traditional issues of war and peace to also begin incorporating the human–environment relationship in the relatively new field of “environmental security” (see United Nations Environment Programme (UNEP) and the Woodrow Wilson Center, 2004; Vogel and O’Brien, 2004). Politically, the imbalance of power among various actors – or of the *perceived* power of particular actors – in water resource development is a concern for those who are attentive to “human security.” In this paper we intend human security to be an inclusive concept focusing on the intricate set of relationships between environment and society as well as encompassing issues of internal stability and sub-acute tensions. These emerging discourses provide valuable insight into the study and management of water resources that are critical for both human and ecological systems.

The term “hydropolitics” came about as substantial new attention was being paid to the potential for conflict and violence to erupt over international waters. The term relates to the ability of geopolitical institutions to manage shared water resources in a politically sustainable manner, i.e. without tensions or conflict between political entities. “Hydro-political resilience” then, is defined as the complex human–environmental system’s (i.e. the institutions’) ability to adapt to permutations and change within these systems. “Hydro-political vulnerability,” on the other hand, is defined by the risk of political dispute over shared water systems (due to a lack of institutional capacity). On the relationship between change, institutions, and hydro-political vulnerability, Wolf et al. (2003) find that: “[t]he likelihood of conflict¹ rises as the rate of change within the basin exceeds the institutional capacity to absorb that change.” The rate of change in the system and the institutional capacity, then, are two key factors in potential dispute settings.

More specifically, Wolf et al. find that very rapid institutional or biophysical changes that outpace the institutional capacity to absorb those changes lie at the root of most water conflict. On the physical side, rapid change outpaces institutional capacity in basins where there are unilateral development projects, unanticipated droughts or floods *and* the absence of cooperative regimes, such as treaties, river basin organizations (RBOs), or technical working groups, or when relations are especially tenuous over other issues. To complicate matters, an increasing rate of some physical changes with basins is being predicted as extreme weather events are becoming increasingly prevalent, making the spatial and temporal distribution of water resources less predictable (Oki and Kanae, 2006). This introduces additional uncertainty and variability for which current institutions (water law, treaties, river basin organizations) may not be prepared.

Like environmental change, socioeconomic and geopolitical systems may evolve rapidly or more slowly. Stress on socioeconomic and geopolitical systems occurs when changes in water demand due to rapid population growth, shifts in land use, or development of technology outpace institutional capacity. An

¹ Here, conflict ranges from strong displays of hostility to mild displays of dissatisfaction (Yoffe, 2001).

Download English Version:

<https://daneshyari.com/en/article/1057843>

Download Persian Version:

<https://daneshyari.com/article/1057843>

[Daneshyari.com](https://daneshyari.com)