Troubled Waters

Climate Change, Hydropolitics, and Transboundary Resources

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Climate Change and Water: Examining the Interlinkages

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Governance at all levels, from international to local, is facing challenges that are transnational and global in nature. States are coming to terms with issues that do not fall wholly under their sovereign control, and find themselves having to cope with problems that may originate beyond their territorial borders. Climate change is such an issue. In attempting to address it, states are compelled to share their policymaking and implementation with a host of other actors at the international and subnational levels.

This paper seeks to engage with these policy dilemmas in the context of the pressures climate change is adding to existing water crises around the world. The transboundary and transnational forces exerted by climate change are fracturing the singular statist frame within which water as a resource was conventionally understood, appropriated, and governed. The paper is divided into three broad sections. The first examines the characteristics intrinsic to climate change and water resource management that make their interface problematic. In the second section, the paper outlines the pathways through which climate change affects water, in terms of both the quality of the resource itself and its larger relationship with natural and human systems. Lastly, the paper explores the key factors or dimensions that mediate this multifaceted interface. It acknowledges the efficacy of existing governance institutions, and the simultaneity of macroprocesses and microbehavior that exert conflicting pressures on the state.

The Complexity of Climate Change and Water

The Politics of Interlinkage

Effective governance of the climate change issue is complicated because of the different scales involved: the level at which action leading to environmental change occurs often differs from the level at which decisions regulating such action are taken. This is further compounded by the fact that water is a transboundary natural resource in its reach, uses, and implications. Rivers, lakes, and oceans traverse multiple states and tie them into common ecosystems. Different water bodies pose diverse challenges to states and communities in

distinct ecosystems. For instance, lakes are more vulnerable to overuse than rivers because of their low regeneration capacity. Rivers are susceptible to sedimentation and the transmission of pollution downstream. Communities living in lower riparian countries depend on water flows from upper riparian states for livelihoods in water-dependent sectors such as agriculture and fishing.

Water has become highly politicized because it is a transboundary resource that is almost always appropriated at a level that does not coincide with its ecosystem limits. This creates management issues and politicization over water rights, distribution, and pricing among the various states through which a river traverses. The manner in which different stakeholders reconcile their interests is key to determining responses to climate change.

There is another crucial way in which the different levels of political control are interconnected, requiring a layered approach to governance: that of the vulnerability of the local level to higher level actions. The resilience and adaptive capacity of local households to cope with the effects of climate change are dependent upon the functioning of systems at the higher levels (national and global), such as information flows, governing and administrative structures, and market and delivery systems that would facilitate the timely passage of information and resources.

Global Causes, Local Theatres of Action

As multidimensional as water may be (given its myriad uses), not all water issues are transnational. Some lakes and rivers traverse national territory without crossing borders. The key issue in this case involves the internal distribution of water rights among multiple users, districts, or provinces, not the competing sovereign claims over the resource. Climate change is a transnational phenomenon in that its cause is geographically removed from the region where its greatest impacts are felt. For instance, climate change resulting from growing greenhouse gas emissions around the world could be the plausible cause for the overflow of a particular glacial lake. The immediate impact of this flooding would be felt at a much lower level than that at which climate change itself occurs. Hence, while causation may be attributed to unbridled industrialization and deforestation occurring at a global level, the communities vulnerable to its fallouts may reside along the torrential course of an affected river basin. The governance of climate change is complicated by the fact that the cause of "national" calamities lies beyond states' sovereign borders.

Livelihoods and life itself depend on the volume and quality of available water, making water scarcity and water securities a concern of every country. All nations seek to maximize their claim over the water traversing their territories. While shared water may be transboundary in its reach and implications, its appropriation as a sovereign resource is not. The transnational nature of water, coupled with the scarcity of the resource itself, has

made the specter of international competition over water a grim possibility. Compounding the conflicting assertions of sovereignty are the different water-related crises brought on by rampant development, such as the impacts of climate change.

What makes water a complex issue? First, a variety of agricultural, industrial, and domestic users compete for it. Different regions such as rural and urban areas may similarly dispute its distribution. Second, surface water supplies such as transnational rivers and lakes are typically considered a common pool resource, that is to say, potential beneficiaries cannot readily be excluded from using it. Such resources are often overexploited because individual consumers cannot easily be made to pay for using the resource or prevented from enjoying it. But variations exist among water types that complicate how the resource is economically defined. Groundwater, for instance, is usually considered to be owned by the person who owns the land from which it is drawn. So while public authorities or user groups may develop mechanisms to manage surface waters collectively, groundwater normally constitutes a private resource vulnerable to unregulated exploitation. Third, the scale of the water resource has implications for the nature and extent of externalities its use may have on other actors and regions. Upstream management of river water affects the quantity and quality available for downstream countries and communities.[1]

In most instances, the water crisis extends beyond the lack of physical availability of water, and can be traced to inequitable access to water resulting from poverty and vulnerability levels across society. Realizing the Millennium Development Goals (MDGs) by 2015 will depend on how humanity tackles the water crisis. The MDG of halving the proportion of the world population that is without sustainable access to safe drinking water and basic sanitation will have implications for the attainment of the other goals and targets regarding education, poverty, malnutrition, health, and sustainable development.[2]

Furthermore, large water management projects have created social, ecological, and economic problems, the repercussions of which cannot be immediately gauged. For instance, China has initiated massive infrastructural projects in Tibet, where many major Asian rivers originate. Industrialization upstream in China has lead to soil erosion, deforestation, and landslides, whose impacts are felt in the lower riparian states of Bangladesh and India. That these countries are part of a common ecosystem was made tragically clear by the flash floods that ravaged northeast India in 2000 caused by a landslide in Tibet.[3]

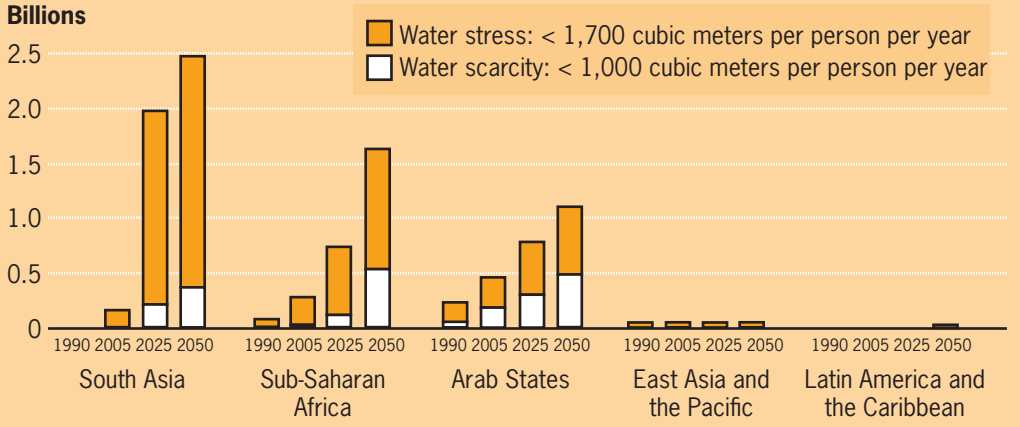
The Impact of Climate Variability on Water Resources

Scientific research suggests that there are strong possibilities of climate variability affecting key spheres essential for human development. The hydrological cycle, like many other natural cycles, functions under a delicate balance across land, ocean, and atmosphere. Hence, any factor that triggers change in these variables would ripple through the sectors

The Looming Water Crisis

About 1.1 billion people in developing countries have inadequate access to water, and 2.6 billion lack access to essential sanitation facilities. Much of this population has access to only about 5 liters a day, as opposed to the minimum daily threshold of about 20 liters. The gender issue embedded in the water crisis cannot be overlooked, since women and girls in underdeveloped and developing countries often bear the brunt of the water crisis—which means more hours of walking to collect water and the associated opportunity cost of missing out on education and personal development. Being denied a fundamental need and human right can trigger unrest in the society. It is essential to underscore the issue of "inequitable access," which defines the differential vulnerability patterns in the water crisis picture as it exists today. About 700 million people in 43 countries fall below the water-stress threshold of 1,700 cubic metres per person (see figure). By 2025, this figure will reach 3 billion, with prominent areas of concern lying in China, India and Sub-Saharan Africa. Globally, some 1.4 billion people live in river basin areas where water use exceeds sustainable levels.

Figure: Populations of Countries Facing Water Stress or Scarcity



Source: UNDP 2006.

that are dependent on the hydrological system. Water is already a scarce resource for reasons having little to do with climate change: burgeoning population, excessive groundwater extraction, and industrial pollution, among others. Projections of the impact of climate change suggest that it would further exacerbate the water stress felt in many places around the world. As the causes of water quality and quantity deterioration become increasingly unclear and diffuse, it will be a daunting challenge for policymakers to attribute responsibility to specific stakeholders for taking corrective action.

One of the more obvious impacts of climate change will be on the world's river systems, many of which will initially see increased flows due to glacial melt followed by decreases

as their source runs out. The Himalayan glaciers extend over 17 percent of the mountain area and contain life-supporting repositories of water that feed the perennial rivers and supply the fertile Indo-Gangetic plains.[4] The annual runoffs in megadeltas, such as the Brahmaputra and Indus, are projected to decline by 14 percent and 27 percent, respectively.[5] This could cause a significant drop in productivity in agriculture and other climate-sensitive sectors. Developing countries in Africa and Asia are especially vulnerable because the impacts are likely to be severe and their coping capacities are weak. India and Pakistan depend on cultivation of arid and semi-arid lands, and hence are likely to face severe impacts in the agriculture sector. For Bangladesh, climate change may cause a shifting of arable zones to the steep slopes in Bhutan. Impact on river water flows would also affect hydroelectricity generation. In Bhutan and Nepal, where hydroelectricity is the source for over 90 percent of the electricity generated (of which a major share is exported), lean flows could significantly affect economies.

There are wide disparities in water distribution between countries and within countries. While there are places with overabundant water resources, there are many that are extremely water-stressed. Climate change could aggravate these disparities by affecting the hydrological parameters that govern the availability of water and by exacerbating the conditions of the poor and vulnerable, thereby limiting their capacity to utilize water as a resource.[6] Effective water resource management needs to address the demand and supply sides simultaneously (see table 1). Conservation practices and technologies, such as better irrigation techniques and water-efficient crop varieties, can significantly reduce the demand stress on the system.[7]

Table 1: Possible Adaptation Options for Water Supply and Demand

Supply side	Demand side
Prospecting and extraction of groundwater	Improvement of water-use efficiency by recycling water
Increasing storage capacity by building reservoirs and dams	Reduction in water demand for irrigation by changing the cropping calendar, crop mix, irrigation method, and area planted
Desalination of seawater	Reduction in water demand for irrigation by importing agricultural products, i.e., virtual water
Expansion of rainwater storage	Promotion of indigenous practices for sustainable water use
Removal of invasive nonnative vegetation from riparian areas	Expanded use of water markets to reallocate water to highly valued uses
Water transfer	Expanded use of economic incentives including metering and pricing to encourage water conservation

Source: Z. W. Kundzewicz et al. 2007.

Threat to Food Security

With large parts of the world dependent on rain-fed agriculture, reduction in water availability coupled with unpredictable changes in rainfall could affect millions of farm-based livelihoods and jeopardize food security. In particular, climate change will result in mixed and geographically varying impacts on food production and create new situations of inequitable access to food. Droughts affect rain-fed agricultural production as well as water supply for domestic, industrial, and agricultural purposes. Some semi-arid and sub-humid regions of the globe (e.g., Australia and the western United States) have suffered from more intense and multi-annual droughts, highlighting the vulnerability of these regions to the effects of climate change.[8] Sub-Saharan Africa is doubly vulnerable owing to high dependence on rain-fed agriculture and abject poverty.

Rising Incidence of Extreme Natural Events

Climate change can lead to an increase in the frequency and intensity of droughts, floods, and other extreme events in water-stressed areas throughout the world. The socioeconomic impacts of droughts arise from the interaction between natural conditions and human factors, including changes in land use, land cover, and the demand and use of water. Excessive groundwater withdrawals exacerbate these impacts.[9] The Intergovernmental Panel on Climate Change (IPCC) reports that projections of rising sea levels range from 0.18 to 0.59 meters by 2100, to which low-lying coastal areas such as Bangladesh and Sri Lanka are highly vulnerable.[10]

Glacial Melting

In several parts of the world, glaciers act as water repositories and feed into the channels for social and economic development of the downstream populations. Over one-sixth of the world's population resides along glacier-fed river basins, and these people would be affected by any change in seasonal flow patterns. Many parts of Central Asia, Latin America, and South Asia depend on glaciers for their livelihoods and sustenance. The glaciers of the Himalayas and Tibet alone feed seven of the world's greatest rivers—the Brahmaputra, Ganges, Indus, Irrawady, Mekong, Salween, and Yangtze—and provide more than 2 billion people with water.[11] Glacial melting that would result from rising global temperatures will lead to initial flooding and heavy flows, and eventually to low flows. This would have severe implications for populations dependent on seasonal rivers fed by glacier melt.[12]

Health Impacts

Changes in the hydrological cycle are certain to affect human health. Climate changes can create conditions in which pathogens can thrive and propagate. South Asia already has the highest prevalence of diarrheal deaths among children below five years of age.[13] The

region has the lowest proportion of rural population with access to decent sanitation, which can increase the spread of disease even more so under conditions of climatic stress.[14]

Key Dimensions Mediating the Interface between Climate Change and Water

Tackling climate change will require a multipronged strategy at the political, institutional, environmental, and epistemic levels. One of the most daunting challenges facing scientists and civil society actors is integrating adaptation and mitigation policies with a country's larger development policies. Initiatives such as afforestation and improved coastal and river management practices would be effective only in tandem with enabling policies in other sectors, such as regulating land use and instituting appropriate incentive structures for users. At present, there exists a high degree of fragmentation and lack of policy coordination among the central ministries. There is an absence of climate change policy linkages among government bodies at the national and subnational levels, and among state and civil society actors at the local, regional, and transnational levels. These together create dissonances at the international level, where negotiators engage with one another in multilateral institutions. Policy incoherence at the national level is often reflected at the international level, where government representatives pursue contradictory or independent negotiation stances in different multilateral forums. However, there is a key variable, critical in explaining the levels of effectiveness of such transnational initiatives, that is often overlooked in most analyses of climate change policy: the nature of a state's political system. To a great extent, the political system and practices determine the degree of openness to a given issue. The political system also determines the nature and extent of participation of civil society actors in policy formulation and service delivery. Access to information on climate change impacts, key to fruitful engagement with other stakeholders, is also a function of a state's political order.

Governance

The nature of the political system has two significant implications for the way environmental change is tackled domestically. First, more open political systems that allow for free expression and flow of information can compel government agencies to respond to environmental crises. A vigilant civil society can act as an early warning system, which, together with inputs from other specialized agencies, draws the attention of the government to imminent crises that require urgent action. However, civil society mobilization is dependent on the availability and accessibility of information, which in most countries is stringently regulated by government agencies.[15] Second, the functioning and efficiency of a political system directly affects its approach to environmental change. For instance, watershed management in India has seen heavy investments in structural activities such as

building check-dams, whereas expenditure on activities aimed at capacity building of local communities through watershed management groups is relatively low.[16]

The State: Speaking in Many Voices?

The internal devolution of powers determines how well equipped implementation-level agencies are to execute region-specific and sector-specific response strategies. All these key dimensions of climate change policy underline the significance of the state as a key actor when it comes to negotiating on a transnational issue such as climate change.[17] But what is often overlooked in analyzing multilateral negotiations is that, far from being a faceless monolith, the "state" is comprised of many actors who at times speak in different voices. Apart from the staple line-up of ministries and bureaucratic entities, many forces seek to have their interests accommodated in any cooperative arrangement. These forces include regional organizations and subnational government bodies, transnational civil society networks, and user associations, each exhibiting its own policy preferences and priorities. It is also possible to identify direct and indirect stakeholders within a water governance framework. Direct stakeholders are those whose livelihoods and sustenance are dependent on water, such as fishing communities, farmers, and pastoralists. The vocations of direct stakeholders are climate-sensitive, making them most vulnerable to climate change. Indirect stakeholders are civil society actors, scientists, specialized agencies, and the state apparatus that participates in governing the resource.[18] Their differing perceptions on what a fair benefit distribution should entail highlight the fact that transboundary treaties seldom rely on objective assessments of benefits. Notwithstanding the desirability of an inclusive regional framework, stakeholder participation in such initiatives has been largely muted in the history of transboundary negotiations.[19]

Governing Water

As with any other issue area, water governance requires making the political system responsive to the exigencies and dynamics of its ecology.* It also demands that policymakers be attentive to the rights of people, to the sustenance and livelihoods of those who are dependent on water.[20] Fashioning an adaptive governance structure that is responsive to the contingencies of time and situation requires significant departures from conventional modes of governance. The conventional approach places centralized institutions in a dominant position with low levels of popular participation. It also demands relatively low levels of accountability and transparency of the implementing agencies. The governance apparatus functions on the assumption that there is a consistent flow of information and feedback into the system, an

* According to the United Nations Development Programme, water governance is "the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" (Joy, Paranjape, and Kulkarni 2008).

ideal seldom found in actual functioning. In practice, information flows are punctuated by inputs from many actors, which can render the system excessively cumbersome.

New approaches stressing adaptive environmental governance seek to locate natural resource management within the larger ecological context. The ecosystem-based approach not only contextualizes the assessment and management of specific resources within their environmental settings, but also factors in the social ramifications of sustainable initiatives undertaken.[21] Adaptive governance structures recognize the entanglement of the social and ecological spheres and so emphasize the need to integrate diverse knowledge systems to better manage the ecosystem. This entails the continuous and dynamic adjustment of management practices through monitoring and feedback mechanisms. In this model, governance moves away from the state as the chief actor in policymaking to engage with a host of other nonstate actors from the civil society and the epistemic community. Information flows are punctuated by inputs from several actors, involvement of which renders the system complex. An adaptive governance system, then, adapts to such contingencies—information deficiency, contending interpretations of data, and eliciting cooperation from other actors—and formulates adequate response strategies.

In actuality, however, there is often a lack of synchrony between governance mechanisms and the nature of water as a resource. India offers an illuminating example. Here there is a high degree of polarization on the water debate, particularly in the interface between state agencies and civil society actors.[22] Furthermore, water management projects tend to be under the command of experts who have abundant technical knowledge but a narrow perspective on resource management. Engagement with policymakers and experts/advocates on other dimensions of water use is necessary for sustainable and equitable resource management. Such an engagement can be worked out within cross-border mechanisms of water governance.[23]

The Issue of Scale

Global climate change is a particularly complex problem since it operates at different scales, simultaneously involving macroprocesses and microbehavior. Hence, local and global issues must be studied in tandem. Localized problems such as pollution and resource depletion build up to create a reduced capacity to cope with climate change impacts. At the systemic level, climate change is compounded by further greenhouse gas emissions. Despite its multidimensional nature, climate change has almost always been approached from a top-down perspective. Global models yield climate change scenarios, which are then interpreted within local contexts. Tackling climate change at multiple scales would entail instituting cooperative arrangements at international and national levels.

The International Dimension

The key to a functional transboundary water arrangement is to regard water as a flow rather than a stock, taking into account basin dynamics and avoiding fixed water allocations to riparians. This explains why most water treaties do not specify set allocations to each participating country.[24] State and nonstate actors increasingly find themselves having to share space, rights, responsibilities, and benefits with one another to manage water expeditiously. In a climate-affected world, statements of intent within multilateral frameworks would need to be expanded to include the sharing of benefits among partnering nations and the sharing of burdens created by climate impacts. Mitigation and adaptation policies would have to be undertaken by all concerned participants for two key reasons. First, since climate change is a porous problem, the solutions must be so as well. States need to accept shared responsibility in any collaborative action plan that is drawn up, especially since isolationist and unilateral policies would be ineffective in combating a global phenomenon. Second, burden sharing requires taking action at different political levels (local, regional, and sub-basin) and involving diverse actors (civil society groups, industry, and scientific monitoring bodies). Working out the nuts and bolts of any burden-sharing mechanism would entail the distribution of costs, compensatory arrangements, and staggered implementation, all of which would necessarily require the financial and infrastructural support of different states.

Benefit sharing is widely touted as the solution to water conflicts around the world, although operationalizing the concept is proving to be tricky. Benefit sharing is appealing because it shifts away from a volume-driven approach to a more ecological approach that specifies and shares the benefits derived from the water source. For countries to participate in a cooperative framework, benefit sharing must offer rewards greater than those of unilateral action. Far from being straightforward, the identification of benefits and the complementarity of interests accruing from a shared water source are a contentious exercise. Costs and benefits usually vary across time frames, typically requiring parties to assume the individual costs before garnering the collective benefit. The mutual gains eventually identified often involve trade-offs among participating countries within a cooperative framework. The more inclusive a regional initiative is among riparians, the greater the likelihood is of forging issue-based linkages over water. It must be stressed, however, that the absence of multilateral arrangements is not necessarily lamentable; successful instances of bilateral agreements exist among countries that constitute a river system subregion. The Indus treaty between India and Pakistan is one such case in which countries draw benefits from a certain sector of the river without significantly impinging on riparians extraneous to the arrangement. Derivable benefits from a particular river system include mitigation of floods and droughts, potential for hydropower generation, agricultural productivity, and enhanced water resource management. These hold wide-ranging implications for current development activities, operational technologies, employment patterns and levels, the economic and health vulnerabilities of populations, and the environment. Benefits vary across time

frames, with immediate gains, such as shared costs of flood mitigation, and long-term gains, such as a well-developed and integrated regional agricultural sector.[25]

The National Dimension

Any analysis of interstate water arrangements must also factor in the subsequent internal distribution of benefits within countries. Leaving aside the centrality of the river basin as a viable unit of analysis, the state remains a key actor at both ends of a water crisis: its cause and its solution. Domestic mismanagement of river water affects the quantity and quality of water available to downstream countries. Similarly, operationalizing any benefit-sharing arrangement would necessarily imply suitably modifying national water policies within a region. Taken together, domestic measures are instrumental in ensuring the effectiveness of any transboundary initiative. Furthermore, allied policies determining the pricing and subsidization of agricultural inputs, such as fertilizers, seeds, electricity, and water itself, have an impact on the level of water efficiency that is achieved in agriculture. It is important to remember that developing efficient solutions on the demand side for existing water sources is more economical than developing new ones altogether.

Moving away from the discourse on water as the sovereign prerogative of a state or a regional resource, another debate has caused more heat than light in the domestic arena. At the center of the debate, which draws in players from industry, donor agencies, and regional organizations, is the issue of whether water should be considered a public good or an economic commodity. It is chiefly a public good in that it is indispensable and has multiple beneficiaries. However, a nuanced approach that factors in competing claims is order. It is here that multi-stakeholder involvement is instrumental in arriving at a middle ground. It must be emphasized that multi-stakeholder participation should not be seen as substituting for certain state functions, such as instituting political processes and arbitrating parallel engagements. While the role of the state is indisputable in decision making, stakeholder involvement ensures that participants become attentive to the stakes of others in the process through continual engagement.[26]

R&D

Scope for Regional Collaboration

Respecting ecosystem dynamics underscores the rationale of regionalism in implementing environmentally sustainable initiatives. The region as the site of resource governance has gained currency in recent times since the sustainable management and consumption of water is optimized at the regional level, thereby reducing environmental stress.[27] Multiple uses and benefits can be derived from regional water resource management, one of which is benefits exchange. For example, the India-Nepal dialogue on river basin management

led to identification of diverse benefits that extend beyond water allocation in a host of other areas, including hydropower and fishing. Initiatives by India such as afforestation drives upstream to contain sedimentation have proven successful in this regard.[28] Emphasis should be placed on Track II initiatives that function through unofficial channels creating a constituency of support in concerned countries. Such initiatives can play a valuable role in preparatory processes, as in the Track II initiatives in the Ganges Treaty in 1996.

Flow of Information

The effectiveness of any transboundary water arrangement depends in large part on the accuracy and availability of data.[29] Transboundary water arrangements vary in the level of collaboration they involve, from data-sharing mechanisms to collective financing and ownership of infrastructural projects. The seemingly elementary exercise of information sharing can pose significant hurdles to cooperation. For one, states, especially upper riparians, often use information as a potent bargaining chip during negotiations. The condition of bilateral political ties influences the extent to which countries want to withhold or share information with other riparians. Beyond the uncertainties associated with information sharing, states disagree on what constitutes credible data. A solution to contending versions of hydrologic data is collaboration on data generation and sharing. For instance, China and India have signed a memorandum of understanding that enables the sharing of hydrological data on the Brahmaputra. Such information will be instrumental in instituting early warning systems and better flood management in the future.[30]

Integrated Impact Assessments

A holistic understanding of the linkages between changes in climatic variables and subsequent impacts on the hydrological cycle is imperative in order to undertake substantial response measures. The availability of models capturing flow changes at the basin level will be crucial in formulating local adaptation measures. It is also essential to downscale climatic data and forecasts for regional or basin-level analysis.[31] The process of stakeholder engagement can be instrumental in arriving at such integrated impact assessments, particularly pertaining to allied activities in different sectors, regions, and communities. However, one of the challenges facing effective stakeholder dialogue is the lack of credible information. This is especially so when opposing parties in water disputes cite different data sets to justify their positions. Furthermore, data access itself becomes an issue since information is often guarded by government agencies as confidential and kept from the public domain. Indeed, stakeholder participation can enable participants to arrive at a consensus on what counts as reliable data.[32]

Response Mechanisms

Formulating river policy at the regional, national, and local levels must situate the river within the larger ecosystem dynamics of which it is a part, recognizing the complex

interlinkages among the social, environmental, cultural, and economic dimensions of the resource. Localized solutions, such as water harvesting for regions facing water scarcity, would offer appropriate response measures while avoiding, as far as possible, reliance on external sourcing. Although significant hurdles exist, cooperative mechanisms that take the sub-basin as the unit must be formulated, and regulatory structures ensuring the sustainable use of water must be instituted.[33]

Conclusion

Important as they are, regulatory and technological measures do not add up to a sustainable water policy. That requires going beyond treating water as a tradable and quantifiable commodity, and grasping its vital significance to sustaining natural and human systems.[34] Any effective governance structure should straddle both the multiple scales (local watershed management and regional initiatives) and parties (actors or stakeholders) within its compass. Given that the involvement of multiple stakeholders implies the articulation of different perspectives on competing water uses, the outcome of such a dialogue need not always yield treaties and agreements. Even negotiations deemed "failed" because of the absence of explicit consensus are valuable for facilitating conversations and channeling dialogue toward new approaches to water resource management.[35] Several current policies and plans have elements that address the issues of water scarcity, degradation of freshwater ecosystems, inequitable access, and their associated consequences. But there is a need to bring together the appropriate elements in order to facilitate adaptation in the water sector to the impacts of climate variability and change. For example, integrated coastal zone management plans and watershed plans could go a long way in assisting adaptation. It is essential that the projections of future trends in water availability and use, flow patterns, and changes in climatic variables form crucial inputs into the planning process. In this regard, policy formulation should factor in traditional forms of knowledge involving conservation practices and water use.[36] Such methods include storage of runoff and the diversion of water from abundant to scarce regions. Response measures should also tap into nonconventional methods such as water reuse and desalination, artificial recharge, and rainwater harvesting.

The nature of new responsive governance mechanisms will be critical in facilitating the coping capacities of the poor and underprivileged. In areas that are vulnerable due to high exposure to climatic extremes and extreme socioeconomic conditions, it becomes crucial to identify possible points of intervention where there is a need for new policy reforms that can ensure equitable allocation and management of water resources.[37] Multilevel governance calls for the harmonization of policies at different political and administrative levels as well as among diverse actors in civil society, industry, and community. This alternative perspective on governance advocates the creation of decentralized institutions that

allow people to participate in designing disaster management strategies.[38] The accountability and transparency of implementing agencies is ensured through feedback mechanisms, and disaster mitigation is built into the development process itself. Forging relationships among the various user groups will be instrumental in mitigating conflicts.

The interlinkages between climate change and water manifest themselves in complex ways that straddle states, continents, sectors, and ecosystems. This requires that policymakers be cognizant of the implications their policies have on other states—a significant departure from the manner in which transnational issues are dealt with today. Currently, there is a general lack of policy direction and political will in tackling the fallout of climate change precisely because states continue to regard natural resource management as a sovereign prerogative where responsibilities and repercussions are clearly demarcated along national and international lines. This is not to wish away the functionality of borders altogether, but there is a growing need to bring national and global agendas on climate change onto the same plane. Furthermore, there exists a significant institutional gap that is indicative of the inability of existing regulatory agencies and legal processes to address the impact of climate change on water at multiple levels. For that, it is imperative to support multilateral and regional institutions, such as the United Nations and the South Asian Association for Regional Cooperation in facilitating coordination efforts among different countries. It is equally necessary to supplement official developments with informal dialogues, which can be instrumental in creating an atmosphere conducive to sustained engagement. Ironically, the very environmental crises created by isolationist and unilateral national policies could compel actors to seek solutions within cooperative frameworks.

Notes

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