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case study

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Participatory river basin management in the São João River, Brazil: A basis for climate change adaptation?

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This paper describes an empirical case study of enhanced water management in the São João River basin on the southeast coast of Brazil between 1999 and 2008. The autonomous adaptation measures applied are assessed to derive lessons for more effective climate change adaptation. In response to severe eutrophication of their coastal lakes, effective, local multi-stakeholder institutions were established under the auspices of the Consórcio Intermunicipal Lagos São João from 1999 to improve basin management. Having significantly reduced the pollution problem, other environmental challenges are now being addressed. In managing environmental problems with multiple causes and effects, engaging multiple stakeholders and communicating the need to change environmental management, these local institutions have established the types of capacities needed for climate change adaptation. Factors contributing to the strengthening of this adaptive capacity include: engagement of local non-governmental organizations, companies and municipal governments; leadership and development of a collective identity; enabling national and state water laws; an ability to raise funds; and implementation of an iterative, adaptive management approach to environmental management.

Keywords: adaptation; Brazil; climate change; institutions; river; São João; water

1. Introduction

This paper examines what motivated the community in the São João region on the coast of southeastern Brazil (see Figure 1) to change their management of the basin and the factors that sustained these processes. It is published here as part of a special edition providing an overarching assessment (Pittock, 2009) of the global lessons derived from the six WWF empirical case studies of autonomous adaptation to climate change in developing countries. We start by reviewing relevant climate change impacts and adaptation concepts before detailing the situation in the São João region.

The Intergovernmental Panel on Climate Change (IPCC) states that 'observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change' (Bates et al., 2008). However, this paper looks at a region where there is very little published literature on climate change impacts or adaptation measures. Climate change forecasts for this area lack high resolution; however, impacts are expected from more extreme events (Pezza and Simmonds, 2005; Dufek and Ambrizzi, 2008), higher temperatures, sea level rise, possible increases in precipitation, exacerbation of water pollution, and loss of biodiversity (Christensen et al., 2007; Magrin et al., 2007; Bates et al., 2008).

Even without climate change the world faces grave challenges in sustaining adequate water

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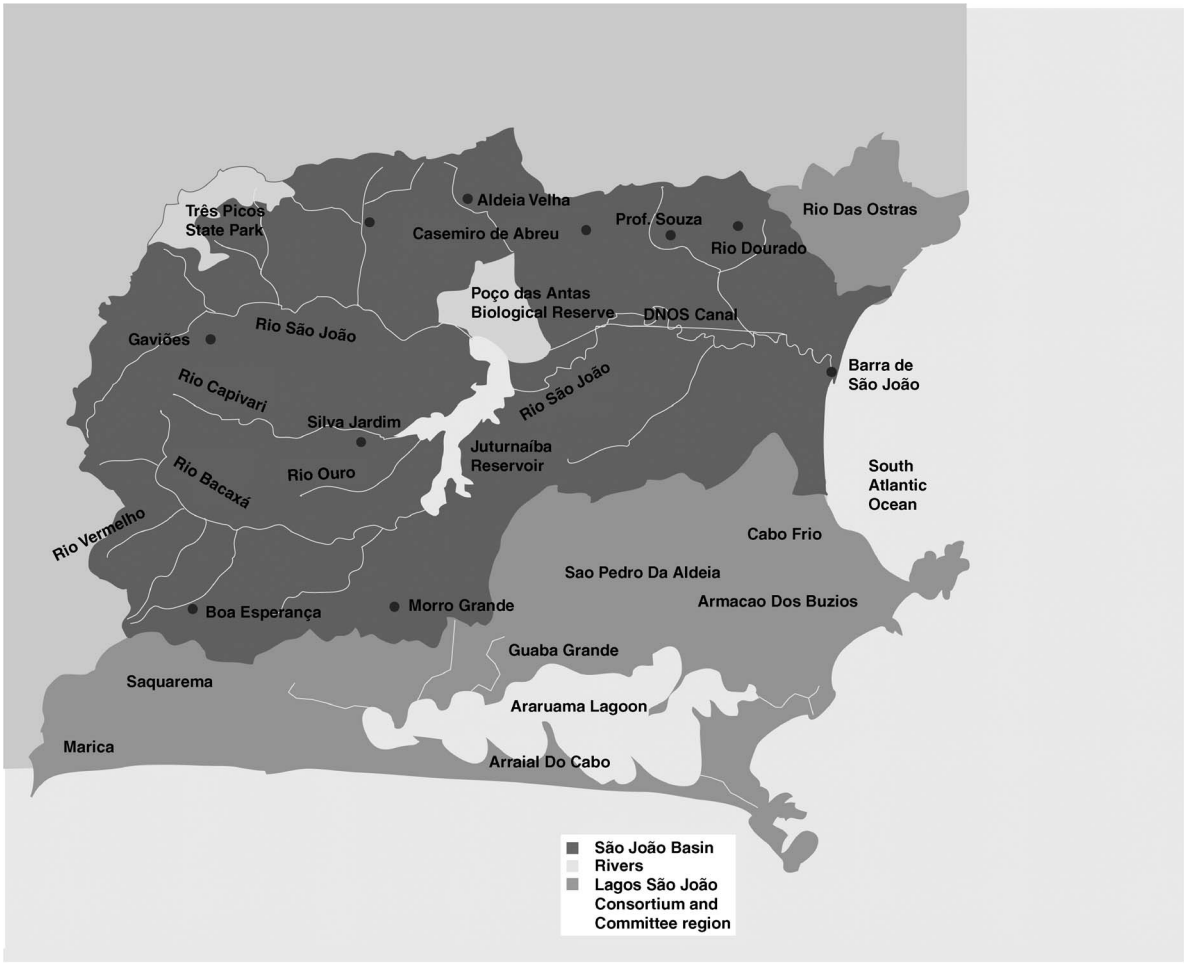

FIGURE 1 Location of the São João River basin (dark grey) and adjacent catchments (light grey) in the Lagos São João hydrographic region

resources, and the water sector has long applied adaptive management practices. The IPCC recognize this in saying (Kundzewicz et al., 2007, p. 196): 'Adaptation to changing conditions in water availability and demand has always been at the core of water management'. The IPCC define this type of 'autonomous adaptation' (Bates et al., 2008, p. 48) as 'those that do not constitute a conscious response to climate stimuli, but result from changes to meet altered demands, objectives and expectations'. We contend that there is much to be learnt for more effective adaptation from these measures. This paper also considers the benefits of such interventions in terms of increasing resilience and reducing vulnerability (Bates et al., 2008).

We believe that the lack of high resolution climate change forecasts requires governments and societies to begin adaptation despite the uncertainties (Richardson et al., 2009). An institutional assessment by Tompkins et al. (2008) of disaster risk management and long-term adaptive capacity building identified four critical factors that led to reductions in risk: flexible, learning-based, responsive governance (such as stakeholder participation, access to knowledge, accountability and transparency); committed, reform-minded and politically active actors; disaster risk reduction

integrated into other social and economic policy processes; and a long-term commitment to managing risk. Tompkins and Adger (2004) argue that 'community-based management enhances adaptive capacity in two ways, by building networks that are important for coping with extreme events and by retaining the resilience of the underpinning resources and ecological systems'. In the related field of river basin governance, similar mechanisms have been proposed for enhancing water resources management, including communities of practice and social learning at different scales and involving diverse stakeholders (Pahl-Wostl et al., 2007); as well as leadership and building collective identities (Abers, 2007).

The IPCC propose a number of adaptation approaches to cope with uncertainty on climate change impacts. These include no-regrets policies 'that would generate net social and/or economic benefits irrespective of whether or not anthropogenic climate change occurs', 'the increased use of water management measures that are relatively robust to uncertainty', and integrated water resources management (Bates et al., 2008).

The potential impacts of and Brazil's options for responding to climate change have been debated in the literature, but this work has largely focused on the Amazon and semi-arid northeast portions of the country, and on issues such as carbon balances, agriculture and biofuel production. Government policy offers little guidance. The 'National Plan on Climate Change' (Government of Brazil, 2008) identifies seven goals, of which two focus on adaptation. The proposed adaptation actions largely involve further research and communication activities, although 'strengthening of environmental sanitation measures' is also proposed.

In the São João River and adjacent coastal basins the biodiverse Atlantic forest remnants give way to farm lands, floodplains and coastal lagoons. The basin falls within the territories of 12 local governments in Rio de Janeiro State. In the 3,825 km^2 region the resident population of 451,000 people swells to approximately 2 million people in holiday periods. The Juturnaiba Dam on the 120 km-long São João River is the main water supply for local people (Dantas et al., 2001). By the late 1990s expanding tourism development resulted in the coastal lagoons silting up and becoming polluted with untreated sewerage, causing a collapse in the fishing industry and impacting on tourism. The São João basin was chosen for this autonomous adaptation case study because of: (a) WWF's long history of work in the region, starting in the 1960s to conserve an endangered primate, the Golden Lion Tamarin, which then led to the establishment of a freshwater conservation programme from 1999; and (b) the reforms in basin management since 1999.

2. Assessment

This paper reviews the changes in management of the São João national hydrographic region from 1999 to 2008 based on research undertaken in late 2008. The study sought to derive lessons concerning (unplanned) autonomous adaptation to climate change, with reference to the success factors for more effective adaptation and river basin management proposed by Tompkins and Adger (2004), Adger et al. (2005), Abers (2007) and Pahl-Wostl et al. (2007). We applied a largely qualitative analytical framework developed by Pittock (2009: Annex) to assess (a) autonomous adaptation, (b) socio-economic and (c) conservation outcomes.

The assessment covers the local implementation of the 1997 national water law and 1999 Rio de Janeiro State water law (ANA, 2007) to decentralize and democratize water management (Brannstrom, 2004; Abers et al., 2006). In 1999 the Consórcio Intermunicipal Lagos São João (the Consortium) was formed by the 12 local governments and now includes four stakeholder representatives from the São João Basin Committee (Bidegain, 2002). This Committee was established in 2004 with membership from three tiers of government, academics, local companies and 58 civil society groups to engage basin residents more broadly and advise the Consortium (Pereira, 2007). Extensive investment in an

environmental education programme from 2003 continues to build public support for catchment management reforms (Kobata, 2006). The Consortium established a process of developing and implementing a basin management plan (Bidegain and Pereira, 2006) with subsidiary work plans. The Consortium is now on its third work plan for the coastal lagoons. The Consortium secured resources from (a) secondment of a staff member from the state government to lead the secretariat; (b) membership fees from municipal governments scaled to reflect the resident populations; and (c) participation fees from local companies. Establishment of a number of sub-basin and thematic working groups from 2005 has facilitated widespread participation in adaptive basin management, increasing local capacities. These institutions were established for integrated river basin management, to progressively solve major environmental problems, starting with water pollution and fisheries management.

3. Results

A number of the key benefits resulting from the strengthened institutions are summarized here in terms of adaptation, livelihood and environmental outcomes. The degradation of the rivers, Juturnaiba reservoir (30 km^2), and Araruama (220 km^2) and Saquarema (24 km^2) coastal lagoons by discharge of untreated waste waters threatened the tourism and fishing industries which comprise 70% of the region's economy. The Consortium, fishing community and allied NGOs lobbied and took legal action against the state government pollution regulator. A key outcome was the renegotiation of water supply company concessions that saw an initial USD38.5 million investment in 2002–2005 in new sewerage treatment infrastructure that has reduced wastewater discharge by 75%. A USD19.3 million second phase is due to collect all waste waters for collection by 2009, and a third phase from 2010 to 2023 is planned to separate storm water from sewerage. In addition, the silted up entrance to the Araruama Lagoon was dredged to restore greater exchange of water with the sea. The substantial reduction of pollution inflows has reduced the threat that eutrophication of lagoon waters would be exacerbated by higher temperatures with climate change.

Substantial socio-economic benefits in restoring the fishing and tourism industries have resulted from the interventions. Improved water quality has seen restoration of mangrove habitats and increases in fish, shrimp and bird populations. The fishing industry has been re-established and now supports 600 families, and the tourism industry has recovered. Economic growth is increasing regional training and employment opportunities. The Consortium has also targeted disadvantaged sectors of the local society who often reside on and farm the most flood-prone lands. For instance, women in two communities are participating in a project to produce handicrafts for sale to tourists as a means of increasing and diversifying incomes to reduce poverty and their communities' vulnerability to extreme events.

Following success in reducing water pollution, the Committee and Consortium decided to scale up work from 2007 to reduce erosion and conserve the water sources and biodiversity through linking and restoring remnant riparian and other wetland habitats. The Juturnaiba Dam will be retrofitted with a fish ladder at a cost of USD400,000 to reconnect populations of migratory species like grey mullet, sea bass and prawns, and the dam's operating rules are being revised. The river bypass canal downstream of the dam will be decommissioned at a cost of USD700,000 to restore the Rio São João's natural course and the adjacent flood plain wetlands. The canal will be converted to aquaculture ponds, further diversifying the local economy. A payment for environmental services scheme is funding previously unemployed residents to restore riparian forests. This is reducing erosion and linking remnant habitats of a threatened primate, the Golden Lion Tamarin, whose population is increasing as the forests are restored. A network of protected areas is being established on private and public lands. Biodiversity and the

fishing industry are expected to benefit further as reconnection and restoration of habitat increases species populations, access to habitat, ability to move to new habitats, and thus resilience to climate change impacts.

As part of this assessment, local residents were asked their views on what made the institutional adaptation successful. Mr Arnaldo Villa Nova, President of the non-governmental organizations involved in the Consortium explained (pers. commun.):

> The Lagos Region has a wonderful natural heritage, which the civil society has always tried to preserve. [...We started the fight in] the year 2000, when we started with an indefinite horizon, and with many doubts and questions to be answered. ... How long will it resist degradation, deforestation, and economic exploitation without any scruples? When can our children play without the risk of getting sick? What can we do to recuperate and preserve the region? ... The strategy applied by WWF in the Lagos Region was for direct support to the NGOs, which allowed the studies, investigations, the planning of projects for environmental recuperation, environmental education activities, as well as giving a definitive structure to the Consortium to accomplish its mission. After some years, the situation today is very different from the one in the beginning of the program. Many activities were implemented to stop degrading environmental processes, and increasing awareness of local government as well as the residents of the region. ... We are half way in our journey: there is a lot to do ....

Ms Denise Pena, a non-government representative on the Consortium focused on environmental education, commented (pers. commun.):

> The proposal of this new model of environmental management, where decisions must be taken by those who are acting and living in the territory of the hydrographic basin, in a decentralized and essentially participative form, could not take root without processes of environmental education, which give conditions for productions and acquisition of knowledge, abilities and the development of attitudes, aiming at an individual and collective participation in this adopted model of management.

4. Discussion

In assessing the changes in the São João region we have identified a number of factors influencing the success and the sustainability of the measures undertaken.

4.1. Motivation for change

The collapse of the coastal lagoon environments and consequent socio-economic impacts on the fishing and tourism industries was the initial motivation for reform. The progress in São João appears to have been aided by funding provided by WWF to help local NGOs build their capacity, provide environmental education and develop a collective identity. This is consistent with Abers' (2007) assessment of other Brazilian river basins. With respect to the debate over whether adaptation is better facilitated by focusing on social and biophysical risk reduction or by development to reduce poverty and enhance livelihoods (Adger, 2006; Schipper, 2007; Tompkins et al., 2008), in the case of São João, the primary investments enhanced livelihoods in the fishing and tourism sectors as well as reducing physical vulnerability. Later and smaller-scale investments sought to improve the livelihoods of other disadvantaged groups, including through employment in environmental restoration. The Consortium's staff say that community awareness raising and engagement, and a virtuous and iterative cycle of successful interventions, has led to community support for further actions. This is consistent with the conclusion of Pahl-Wostl et al. (2007) that social learning institutions are vital, and Dovers (2005) who identified iterative programme cycles as being an element of

successful sustainability policies. It is also consistent with Tompkins et al. (2008) who argue that stakeholder participation, access to knowledge, accountability and transparency are central to building long-term adaptive capacity.

4.2. Sustainability and funding

Institutional sustainability of these measures is enhanced by the local community engagement, mandate from the national and state water laws, and the fundraising capacity of the Consortium (Mea, 2007). While municipal and company fees do not pay all programme costs, they do enable leverage of other funds, including the secondment of state government staff. The basin institutions in São João differ from those in other parts of Brazil as they combine downward accountability through the leading role of municipal governments in the administrative Consortium, together with multi-stakeholder participation through the advisory council. This appears to compare favourably with three other institutional models for decentralized water resources management in Brazil (Brannstrom, 2004) in terms of promoting reform, limiting conflicts, maximizing community engagement and accountability. This highlights the importance of concurrent measures across geopolitical scales, in this case at the individual, basin, local, state and federal government levels, for effective adaptation (Adger et al., 2005).

The management interventions undertaken thus far appear to address some but not all likely impacts of climate change. The likelihood of algal blooms with warmer weather has diminished greatly with the extension of wastewater treatment, and further benefits for aquatic biodiversity and fisheries, reduced erosion and water quality are likely from the restoration of riparian forests, the construction of a fish ladder and removal of the channelized section of the river. Furthermore, some of the region's poorest communities have higher and more diverse incomes, enabling them to cope better with disruptive events. On the other hand, little thought has yet been given to management of more frequent high rainfall events or to likely rises in sea level. However, the strength of the community-based management institutions supports Tompkins and Adger's (2004) proposition that greater adaptive capacity has been established through stronger social networks and by retaining the resilience of the underpinning resources and ecological systems. The problems dealt with by the river basin management institutions to date have the same attributes as those of climate change adaptation challenges: multiple cause and effect linkages, multiple stakeholders and communication of the need for changes in environmental management. Having addressed eutrophication of regional water bodies and now riparian restoration, there is the capacity and will in the basin institutions to manage the new problems expected to come with climate change.

4.3. Barriers and lessons

Until this study commenced, the basin management institutions had not considered how to manage climate change. They appeared discouraged by the uncertainties in data available on the likely local impacts of climate change and lack of locally available expertise. The Consortium staff saw the climate change information available to them as lacking salience (Meinke et al., 2006). As a result of this research, the Consortium staff are now inspired to reassess how their programme can now become more climate informed, including by implementing further no-regrets adaptation measures.

This case study highlights the importance of strong local institutions for adaptation. The extensive public communication and engagement has made government institutions more accountable and responsive (Costa, 2007). The multi-stakeholder Committee and Consortium processes built partnerships and consensus for change, and stopped 'buck-passing' between governments. This is consistent with the systematic social learning promoted by Lee (2003). The

Consortium secretariat was kept small and work was contracted out to other institutions in the basin, enhancing engagement, partnerships and capacities for reform. The basin institutions' subsidiarity mechanisms enhanced local ownership of problems, innovation and successful responses, consistent with Abers (2007).

4.4. Potential to scale up

Brazil's national and state water laws could enable similar work in the approximately 140 similar river basin institutions across Brazil. Abers (2007) and Brannstrom (2004, p. 231) outline factors that have favoured or hindered decentralized stakeholder governance in other Brazilian basins, and by comparison the São João institutional framework appears 'to encourage a three-way dynamic among central authorities, local government and civil society' and develop a common local identity particularly effectively.

5. Conclusions

Management of the São João basin did not consider climate change, but the institutional reforms and other interventions have established a strong basis for building resilience and reducing vulnerability. A number of lessons can be drawn from this case for more effective adaptation to climate change:

- Severe pollution of the region's water bodies helped mobilize non-governmental organizations and local leaders to respond.
- Three factors were crucial to the success of national and state river-basin management institutions in facilitating reform at the basin scale: bringing together diverse stakeholders to work towards a common vision; local ownership; and an independent financing mechanism.
- Concurrent investment in activities that both reduced vulnerability and enhanced livelihoods generated community support and inspired community confidence in new interventions by achieving substantial early successes.
- Proponents of mainstreaming climate change adaptation must communicate in salient language and illustrate 'no- and low-regrets' options that are effective despite uncertainties as to climate change impacts.

The reforms at São João highlight the opportunities to mainstream climate change adaptation through river basin management programmes.

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