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# Managing watersheds for urban resilience

## Policy Brief

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for urban resilience"

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**Key messages:**

1. Well-managed, healthy watersheds provide a wide range of goods and services to both urban and rural populations and play a vital role in supporting urban life.
2. Urban areas are dependent on watersheds, yet urban expansion and land use changes have contributed to watershed degradation, increasing urban exposure and vulnerabilities to water-related hazards.
3. Risk-sensitive, sustainable watershed management balances resource needs amongst multiple users both upstream and downstream, and also reduces vulnerabilities and develops coping capacities to deal with potential disaster risks through mitigation and preventive actions.
4. Ecosystem-based approaches in watershed management, such as reforestation, river or wetland restoration, and floodplain regulation, when combined appropriately with engineered infrastructure, can provide complementary solutions to help achieve urban development goals, as well as protect people and development investments against water-related disasters and climate change.
5. Successful watershed management is based on stakeholder consultations across geographical, institutional and political boundaries and requires strong, long-term political, technical and financial commitments.

**Policy recommendations:**

1. Ensure that policies and legal frameworks are in place to support, replicate and institutionalize the practice of risk-sensitive, sustainable watershed management, across political and institutional boundaries.
2. Integrate sustainable watershed management as part of urban development planning and urban risk management.
3. Enhance capacities to undertake risk-sensitive, sustainable watershed management planning in urban areas.
4. Promote innovative approaches to overcome capacity limitations, such as fostering public-private sector partnerships.
5. Support community and civil society involvement in watershed planning processes to build ownership and long-term support.

This policy brief is intended to raise awareness of the importance of sustainable watershed management for resilient urban planning, and to provide recommendations on how city and municipal governments can effectively utilize a watershed management approach for urban risk reduction. The policy brief aims to contribute towards the International Strategy for Disaster Reduction (ISDR) Global Campaign “Making Cities Resilient”<sup>1</sup> and strategic outcomes of the 2011 Global Platform for Disaster Risk Reduction.



## 1. Disaster risk in an urbanizing world

Urban areas are expanding globally, with increasing populations and migration from rural to urban centres. Already more than 50 percent of the world's population lives in cities, with a projection of 70 percent by 2030. Much of urban growth will take place in low and middle-income nations and mostly in hazard-prone coastal areas and flood plains.<sup>2</sup> As people, homes, infrastructure and industry become increasingly concentrated in cities, urban risk is also expected to increase.<sup>3</sup> Due to location, many cities are already exposed to multiple hazards, such as earthquakes, landslides, floods, and coastal storm surges.<sup>4</sup> However, cities that are exposed to hazards are not necessarily disaster-prone. Many hazards only become disasters when there are existing vulnerabilities that limit or reduce the capacity of individuals and society to manage, cope with and recover from hazard impacts. For instance, urban growth may take place in informal settlements, where housing construction is often of poor quality and basic infrastructure (drainage, waste disposal, water supply) is lacking. This multiplies disaster vulnerabilities, especially for the poorest segments of the population, who tend to settle in hazardous places in and near urban areas.<sup>5</sup> Enhancing urban resilience against disasters means reducing exposure and vulnerabilities, including those induced by ecosystem degradation.

Local governments, as the closest authority to the population and its territory, are recognized as key players in building resilient communities – communities that are better able to resist, cope with and recover from large and small hazards. Local governments are often the first to respond in case of disasters, but they are also responsible for providing key services and addressing multiple development priorities. Through an integrated approach to watershed management and urban risk reduction, city and municipal governments can seek to achieve their development goals as well as protect people and development investments against disasters.



The Nadi River Basin, Fiji © C.Warmenbol / IUCN

### **Case study 1. Managing the Nadi Catchment Basin for flood risk reduction, Fiji**

Spanning an area of 512 km<sup>2</sup> and supporting approximately 51,000 inhabitants<sup>6</sup>, the Nadi River Basin is of vital importance to Fiji. Nadi supports the country's main tourism centre and has major urban settlements, surrounded by sugarcane farming as the main agricultural activity in the watershed.

Heavy rainfall events in January 2009 were considered to be the worst in 75 years. The Nadi River peaked at 8 meters, flooding the Nadi Town and other low lying areas, affecting local businesses, tourist resorts, farmers and community residents. Economic costs of the 2009 floods in Nadi alone were estimated to be USD 73 million.<sup>7</sup> Although floods are common in Fiji, flooding incidences have increased in recent decades, posing significant challenges to flood risk management in the country.<sup>8</sup>

Flood risk reduction in Nadi would require improved economic and social development, urban land-use planning and watershed management. Since the 1980s, mainly as a result of receiving preferential access to European markets, sugar cane growers have expanded into the hills and onto steeper slopes. Sustainable farming practices, such as contour farming and use of vetiver grass, have declined, resulting in increased erosion and siltation of water bodies. The 1987 political coups also reduced public services, resulting in deterioration of water drainage systems and increased flood events.<sup>9</sup>

Presently, there is fragmented institutional and governance arrangements over land-use planning in Nadi and elsewhere in the country, which impede flood risk reduction efforts. The Nadi Town Council and Nadi Rural Local Authority are responsible for land-use planning, but many developments have been allowed that have affected drainage systems. Multiple government agencies are mandated to tackle rural and agricultural development, but their policies, plans and strategies are not harmonized and often remain unenforced, further exacerbating watershed degradation and contributing to excessive flooding.

To tackle these challenges, a Nadi Basin Coordinating Committee (NBCC) has recently been established under the UNDP-GEF funded Integrated Water Resource Management (IWRM) Project, supported by SOPAC and IUCN. NBCC stakeholders include: the Fiji Meteorological Services; the National Disaster Management Office; Ministry of Agriculture and Forestry, Lands Department; and the Nadi Town Council. The project is developing a "Ridge to Reef – Community to Catchment" IWRM approach that emphasizes policy and legislative reform and capacity development for national water resource management for sustainable development and flood risk reduction.<sup>10</sup> The project will contribute towards improving disaster risk management (including disaster preparedness, response, recovery and rehabilitation efforts) under an IWRM framework.

#### *Additional information:*

Lal, P. N. 2010. "Vulnerability to natural disasters: An economic analysis of the Fiji 2009 floods on the Fijian sugar belt". *Pacific Economic Bulletin* 25(1): pp. 62-77.

<http://www.sopac.org/index.php/water-governance/iwrn-programme/gef-iwrn-project>

## 2. Linking watersheds and urban resilience

A watershed encompasses the land area that water flows across or through on its way to a shared stream, river, lake, estuary or ocean. Also referred to as catchment basins, watersheds capture and store water from the atmosphere, but also release water slowly or rapidly through various water bodies. Watersheds often cross administrative or even national boundaries, and can traverse areas of wide geographic, ecological, social and economic diversity.<sup>11</sup> Important ecosystems within a watershed may include upland and lowland forests, rivers, streams, lakes, wetlands and mangroves. The unique combination of climate, geology, hydrology, soils and vegetation as well as anthropogenic (human-induced) activities shape and influence the watershed landscape, especially the condition of land and water resources.<sup>12</sup>

Watersheds provide a wide range of goods and services to both urban and rural populations and play an important role in supporting urban life and development (Box 1). Increasing or preserving tree coverage in upland zones helps maintain water quality and quantity in urban areas located downstream. Today at least one third of the world’s biggest cities, such as, Singapore, Jakarta, Rio de Janeiro, New York, Bogotá, Madrid and Cape Town draw a significant portion of their drinking water from forested catchment areas.<sup>13</sup> Well-managed, healthy watersheds maintain water run-off, reduce erosion, filter sediments and polluting materials, stabilize slopes and stream banks and in many cases reduce the occurrence of shallow landslides and floods. Watersheds are also a source of economic goods that are vital to livelihoods and economies, and provide spaces for recreation and cultural heritage.

<b>Box 1. Watershed ecosystem services</b>	
Watershed physical and biological processes and resources provide a wide range of goods and services to human populations, including <sup>14</sup> :	
<p><i>Provisioning services</i> Services focused on directly supplying food and non-food products:</p> <ul style="list-style-type: none"> <li>• Freshwater supply</li> <li>• Crop and fruit production</li> <li>• Livestock production</li> <li>• Fish production</li> <li>• Timber and building materials supply</li> <li>• Medicines</li> <li>• Hydroelectric power</li> <li>• Transport and navigation</li> </ul>	<p><i>Regulating services</i> Services related to regulating flows or reducing hazards:</p> <ul style="list-style-type: none"> <li>• Regulation of hydrological flows (buffer run-off, soil water infiltration, groundwater recharge, maintenance of base flows)</li> <li>• Natural hazard mitigation (e.g. flood prevention, peak flow reduction, landslide reduction)</li> <li>• Soil protection and control of erosion and sedimentation</li> <li>• Control of surface and groundwater quality</li> <li>• Climate regulation</li> <li>• Carbon regulation</li> </ul>
<p><i>Supporting services</i> Services that support habitats and ecosystem functioning:</p> <ul style="list-style-type: none"> <li>• Wildlife habitat</li> <li>• Flow regime required to maintain downstream habitat and uses</li> </ul>	<p><i>Cultural, religious and amenity services</i> Services related to recreation and human inspiration:</p> <ul style="list-style-type: none"> <li>• Aquatic recreation</li> <li>• Landscape aesthetics</li> <li>• Cultural heritage and identity</li> <li>• Religious, artistic and spiritual inspiration</li> </ul>

## **Case study 2. Protecting and restoring the Miyun Watershed for livelihoods and city resilience in China<sup>15</sup>**

Over the last 30 to 40 years, substantial efforts were made to reforest the Miyun landscape in China. The Miyun reservoir supplies up to 80 percent of the water used in Beijing, China's capital city, which has been experiencing worsening water scarcity. This problem is directly attributed to the disappearance of much of the original broadleaf forest in the Miyun Watershed.

In response, the Government instituted strict controls on land and forest use from the mid-1980s, including a total ban on logging, and invested substantially in reforestation and planting large areas of conifers and other species. Today, these strictly protected, young, even-aged stands of trees are in poor condition and contribute little to soil, water and biodiversity conservation, mainly because they have not been actively managed. Also as a result of the logging ban and strict regulation of forest access, local communities outside of Beijing have become progressively disadvantaged in economic terms over the last decades. There are few alternative income sources in the area, as cash incomes have traditionally been associated with forest products.

Since 1995, the Beijing Municipality has compensated Chengdeh and Zhangjiakou Cities in the Hebei Province for the protection of the Miyun watershed. Currently the annual payment is USD 2.5 million, of which USD 1 million goes to Zhangjiakou. Funds are used only for specific purposes, including adoption of soil and water conservation measures and subsidies to farmers who convert paddy fields to dry farmland, forest land or grass land.

However, it was clear that the strict logging ban needed to be replaced with a new forest management strategy. In 2007, IUCN initiated a project that recognised the multiple needs and functions of the watershed and brought together the many different stakeholders and sectors with an interest in the watershed. A new set of forest management tools were introduced, representing a shift from a strict, protection-oriented approach towards more sustainable resource use through active management by forest-based communities.

Participatory planning has resulted in the formal recognition of different forest management and use regimes, harmonising the technical information held by Government foresters with local knowledge and priorities. Local communities are responsible for applying silvicultural treatments that improve forest structure, quality and function. A permit for harvesting timber has been secured – the first to be issued in more than 20 years. A new system of harvesting fuel wood has been set in place, while significant progress was made in reducing local fuel wood demands. Finally, support has been provided to establish community-based cooperatives for marketing forest goods and services, with the aim of increasing and diversifying local income.

### **3. Urban risk and watershed degradation**

Urban expansion, unplanned development and inappropriate land use - all linked to poor governance - have contributed to significant degradation of watersheds through deforestation, wetland reclamation, river channel alterations, urban pollution, and impervious surfaces (e.g. roads and paving, rooftops, etc.). This can diminish the natural regulating and buffering functions of watersheds against water-related hazards such as floods, landslides and drought, as well as reduced watershed capacities to provide vital products and services on which urban areas and local livelihoods depend. Human activities upstream and in peri-urban areas, can increase siltation and blockages of drainage systems, reduce ground infiltration and exacerbate run-off. Downstream communities are often forced to offset the loss of ecosystem services

from watersheds, generally through costly engineering such as flood control projects and water and sewage treatment plants.<sup>16</sup> Increasingly, combined approaches that utilize both engineered and environmental infrastructure are being recognized as complementary solutions to provide protection, reduce risk and maintain functioning ecosystems and the goods and services they provide.

Climate change can exacerbate existing risks to watersheds and urban populations, with more unpredictable and extreme weather events. For instance, heat waves increase energy demand for cooling. During drought periods, energy generating stations have limited capacities to discharge cooling water, and areas reliant on hydropower may face interrupted supplies. During floods, water supply networks and wastewater treatment systems are often at risk from both physical damage and contamination.<sup>17</sup> Planning for the future means improving present capacities to cope with future shocks, but also requires changing consumer demands and lifestyles and balancing multiple sectoral needs for watershed services.

### **Case study 3. The Marikina Watershed Integrated Resource Development Alliance: Building partnerships for disaster risk reduction in urban centres of Metro Manila, Philippines**

The Marikina watershed located in the wider metropolitan area of Manila, the city capital, spans 28,000 hectares of what used to be rainforests and cuts across three main townships (Antipolo, San Mateo and Rodriguez). Only roughly 20 percent of the rainforest remains.

In late 2009, the Philippines was battered by tropical storm Ondoy and typhoon Pepeng, leaving nearly a thousand dead and thousands homeless, with total damage and losses estimated at USD 4.38 billion. The intensity of flash floods that devastated the Metro Manila region was attributed to the degradation of the Marikina Watershed.

Local government leaders - led by Marikina City Mayor and the Mayors of Pasig City, Antipolo City, Cainta City, Quezon City, Rodriguez and San Mateo – also known as the “Alliance of Seven”, in September 2010 signed a Memorandum of Agreement and committed to work together to rehabilitate and sustainably develop the Marikina Watershed under the framework of disaster risk reduction and enhancing urban resilience. Proposed actions include rehabilitation and reforestation of the Marikina Watershed, including a review of existing policies, resettlement plan for high-risk communities and possible in-city relocation and livelihood assistance, as well as the development of harmonized mechanisms within a sustainable and climate-sensitive plan for the Marikina Watershed.

Emphasis is also placed on building partnerships not only between the seven city governments but also with other key stakeholders across the seven municipalities, including civil society and the private sector. The Alliance of Seven is working with citizens groups and local NGOs, and will also build on previous reforestation efforts by the United Coconut Planters Bank, a private bank, which started in the 1990s to rehabilitate the Marikina Watershed.

*Additional information:*

<http://www.mb.com.ph/articles/309591/workshop-disaster-reduction>

<http://envicluster.wordpress.com/2010/10/19/business-mirror-alliance-of-6-works-to-bring-marikina-watershed-to-life/>

<http://www.businessmirror.com.ph/component/content/article/53-agri-commodities/2630-alliance-of-6-works-to-bring-marikina-watershed-to-life>



#### 4. Good practices in sustainable watershed management for urban resilience

Urban policymakers and planners need to incorporate risk-sensitive, sustainable watershed management as part of development and land-use planning, in order to build urban resilience against water-related hazards and the effects of climate change. In the past, watershed management approaches heavily utilized engineered technology such as dykes or river channelling and were typically much more centralized at the national level. Recent experiences in effective watershed management have moved towards an ecosystem-based approach, which may still be complemented by engineered solutions as appropriate. Sustainable watershed management balances water needs amongst multiple users while it protects the long-term ability of ecosystems to capture, store and release water. Incorporating risk-sensitivity in watershed management regulates resource use (i.e. land and water) in order to prevent or reduce the impacts of water-related hazards and to develop coping capacities to recover from these hazards.



The Charles River Esplanade, Boston, Massachusetts, U.S.A. July 2005 © Wikimedia Commons, Daderot



#### **Case study 4. Restoring Boston's Charles River Watershed, U.S.A<sup>18</sup>**

The Charles River Watershed in eastern Massachusetts extends from Boston's western suburbs to the heart of the city. The watershed, with a population of about 900,000 people, spans 35 towns and cities, 27 of them entirely drained by the Charles River. More than 10 percent of the watershed (about 8,000 hectares) consists of freshwater wetlands. Historically, the Charles played a key role in the founding and growth of Boston, enabling the city to serve as port and marketplace and as an important link to inland settlements.

By the 1960s the Charles River had become an eye sore, heavily polluted by industrial and sewage discharges and degraded as a habitat. Flooding, however, was the most pressing problem in the 1960s, posing a major threat to low-lying areas, as suburban development covered the watershed with impervious land cover and structures on the floodplains. After a series of floods in the 1950s and 1960s, local and state political leaders charged the Army Corps of Engineers to design a flood control project for the Charles. Established in 1965, the Charles River Watershed Association was established and challenged the Corp's conventional concrete-based flood control strategy. The Corps and CRWA worked together to produce a novel plan in 1970 to reduce flooding in the watershed through a three-point strategy: acquisition and protection of several thousand acres of remaining wetlands for water storage; encouragement of floodplain and wetland regulation by watershed towns and cities; construction of a new dam at the river's mouth to alleviate overflow of the basin in Boston and Cambridge. The protection of wetlands and floodplains signalled a new approach to watershed management in the country, which was endorsed by the national Congress (the legislative branch of the US Government).

By 1983, about 8,100 of natural wetlands were acquired from private owners by the Corps and transferred to state and local authorities for management as natural flood storage and ecological restoration sites. Concurrently, several municipalities in the watershed began to regulate wetland use by public and private activities. Such regulations helped preserve natural water storage, reduced development in the floodplains, and reduced pollution of wetlands and streams. Because the wetlands were protected and allowed to perform their natural functions, the Charles River began to regenerate. Efforts towards rehabilitation, especially with respect to monitoring and improving status of river water quality, continued throughout the 1990s and 2000s. After four decades, the CRWA has achieved measurable improvement, particularly in flood mitigation, water quality and public recreation.

*Additional information:* <http://www.crwa.org/index.php>

#### **4.1 Establishing appropriate governance frameworks to support sustainable watershed management**

In many countries and regions, such as in the United States, Australia and in the EU, where watershed management approaches have been actively promoted and implemented over many years, there are established legal and regulatory frameworks, namely water protection laws, that provide the legal mandate and establish the institutional and funding mechanisms for implementing watershed management strategies.

Protected area (PA) management, forest conservation and protection laws have also been used to protect, restore and sustainably manage parts of upper catchment basins, but often only cover a limited geographic area. PAs and other conservation approaches may only be effective to a certain scale depending on the size of the watershed and populations living in the basin. Hence, it remains critically important to manage the urban area and watershed in combination.

## 4.2 Linking upstream and downstream users

Urban centres need to recognise their reliance on the ecosystems around them as part of the wider watershed, and the impact they have downstream.<sup>19</sup> Coastal cities bring additional complexity when they are reliant on the upstream watershed and thus are responsible for maintaining ecosystem services from both upstream and downstream areas such as estuaries, deltas and coastal receiving waters.

Experiences in effective watershed management stress balanced negotiation and partnerships amongst multiple stakeholders and watershed users.<sup>20</sup> Good practices in watershed management balance the roles and responsibilities between local and national government entities, local communities, civil society and the private sector, as shown in watershed restoration efforts in the Philippines (case study 3) and in Boston, USA (case study 4). They demonstrate coordinated efforts across a catchment area, which may extend beyond a city's or municipality's jurisdiction, involving upstream and downstream communities. This provides greater opportunity and incentive for local governments to actively participate in watershed management planning processes and work with other stakeholders of a common watershed area. For example, Beijing compensates neighbouring cities through annual payments for protecting the Miyun Watershed, a major source of the capital's water supply (case study 2).

Depending on the size and scale of the watershed, the municipal or city government may be required to work together with other relevant jurisdictions under some type of watershed planning forum or platform. In cases involving larger scale regional watersheds, a multi-level or multi-tiered mechanism will be needed to coordinate actions at the macro- and micro-watershed scales, as shown in the Tacana River Basin (case study 5).

**Case study 5. Transboundary watershed management for risk reduction in the Tacana River Basin, Mexico and Guatemala**



**Damage to mango and banana plantations and other crops as a result of flooding due to Hurricane Stan, October 2005, (Mazatlán, Chiapas, Mexico) © IUCN / Taco Anema**

In 2005, Hurricane Stan caused severe flooding and mudslides in Guatemala and Mexico, with over 2,000 deaths and material damages of up to USD 40 million. Roads, bridges, water supply systems, crops and other livelihood assets were destroyed. The devastation served as a catalyst to reduce the impact from future hurricanes.

IUCN, the Fundación Gonzalo Río Arronte (FGRA) based in Mexico and the Dutch Embassy based in Guatemala initiated an integrated watershed management programme on the border area between the department of San Marcos, Guatemala, and the state of Chiapas, Mexico, encompassing the watersheds of the Suchiate, Coatlán and Cahoacán Rivers. Severe degradation of the watersheds due to deforestation and soil erosion have aggravated the impacts of intense storms, with communities in the upper and lower watersheds facing increased vulnerability to flooding.

Through ecosystem restoration, such as soil conservation and sustainable agricultural practices, the project aims to reverse watershed degradation; secure water supply to settlements, agriculture and livestock downstream; and reduce the risk of devastating floods caused by tropical storms and hurricanes. The project also seeks to ensure that local authorities and natural resource-dependent people have tools and information to develop and implement water resource management plans. The project promotes multi-stakeholder participation, and local communities are now organized into micro-watershed councils that have developed micro-watershed management plans for villages. Project activities include: capacity development, controlling erosion through sustainable agriculture, integrated solid waste management plans, disaster preparedness, among others. Subsequent agreements have been signed with national, regional and municipal organizations, and a river basin committee for the Cahoacán River has also been established.

*Additional information:*

[http://www.iucn.org/about/work/programmes/water/wp\\_where\\_we\\_work/wp\\_our\\_work\\_projects/wp\\_our\\_work\\_trb/](http://www.iucn.org/about/work/programmes/water/wp_where_we_work/wp_our_work_projects/wp_our_work_trb/)

<http://www.waterandclimate.org/UserFiles/File/PersPap%2002.%20Environment%20as%20Infrastructure.pdf>



### 4.3 Incorporating hazard mitigation and risk reduction as part of urban development and watershed management planning

The creation of a watershed management strategy for the respective basin is essential. Watershed management plans outline actions needed over time and should be used as a roadmap to achieve and maintain a healthy watershed. There are many ways to undertake this process, but the most important (and challenging) aspect is collectively defining the key goals and required actions across stakeholder groups.

Sustainable watershed management is often driven by the need to ensure water supplies (e.g. for drinking water, agricultural production, industries). However, management actions are also focused on controlling sedimentation, maintaining downstream flows for environmental needs, and the mitigation of water-related hazards. This approach provides an incentive for urban/city governments to invest in watershed management approaches (case studies 1-4). Urban development planning must therefore take into account sustainable watershed management in order to benefit from the multiple services provided by watersheds, including urban risk reduction.

A risk-sensitive, sustainable watershed management approach considers not only the sustainable use of resources but also reduces underlying vulnerabilities and develops coping capacities to deal with potential disaster risks through mitigation and preventive actions. For example, ecosystem-based flood reduction measures, for instance through reforestation and river bank restoration, provide additional benefits, such as soil quality improvement, aquatic habitat enhancement and fisheries restoration, that directly support local livelihoods (case studies 3 and 4). It is also important to address the major drivers of watershed degradation, including poor governance, unsustainable land-use on steep and fragile areas, and climate change, which contribute to increasing disaster vulnerability. Agreed upon watershed goals and management strategies can then be incorporated into the land-use decisions and development plans of city/urban governments, as part of a coordinated effort with adjoining jurisdictions and relevant stakeholders.

## 5. Policy Recommendations

The following highlight policy recommendations, which also address current challenges in applying risk-sensitive, sustainable watershed management.

1. **Ensure that policies and legal frameworks are in place to support, replicate and institutionalize the practice of risk-sensitive, sustainable watershed management, across political and institutional boundaries.** Many known successful cases of watershed management are found in more developed countries, where the relevant legal and regulatory frameworks and institutional mechanisms are in place. In most developing countries, the enabling environment needed to support effective watershed management partnerships is still emerging. The case of Nadi in Fiji demonstrates the challenge – and opportunity – in establishing policy and legal reforms that can result in harmonized land-use plans and coordinated watershed management (case study 1). It is important to ensure that watershed management frameworks are aligned with urban development and risk management frameworks, in support of improved ecosystems management for sustainable development and urban resilience. Developing the appropriate policy and legal environment helps to “mainstream” good practices as part of institutional functions and processes and move beyond project-level or pilot interventions. This helps to create incentives for city governments to collaborate with neighbouring municipalities and jurisdictions as well as with the relevant national and regional authorities (watershed managers, water authorities, disaster managers, protected area managers, etc.).
2. **Integrate sustainable watershed management as part of urban development planning and urban risk management.** Watershed management recognizes multiple watershed users and facilitates

prioritization of the benefits through a more coordinated management approach. Ecosystem-based risk reduction measures, such as river, stream and wetland restoration and floodplain regulation, should be incorporated into urban land-use and investment plans, recognizing their additional benefits for livelihoods (both upstream and downstream), biodiversity, recreation and enhanced adaptive capacities to climate change. Ecosystem approaches may be considered alongside engineered solutions to maximize benefits, while taking into account sustainability criteria.

3. **Enhance capacities to undertake risk-sensitive, sustainable watershed management planning in urban areas.** This should be a focus area in countries where environmental and urban governance is poor, and technical and financial capacities limited to undertake the required risk and vulnerability assessments, environmental assessments, scientific monitoring as well as the intensive stakeholder consultation processes called for in risk-sensitive watershed management planning.
4. **Promote innovative approaches to overcome capacity limitations,** such as fostering public-private sector partnerships. The private sector is a key stakeholder. It can leverage both the technical and financial resources needed to support watershed management, as illustrated in the case study from the Philippines.
5. **Support community and civil society involvement in integrated watershed and urban planning processes to build ownership and long-term support.** Good practices in watershed management have shown the critical role played by local community groups, such as water user associations or micro-watershed councils, agricultural groups, growers, fishing groups, irrigators, etc, in setting priorities and implementing and supporting proposed actions. There is a need to link groups with those in the peri-urban and urban environment to raise awareness of the resource use and sharing elements, and disaster risk reduction responsibilities.

#### **Case study 6. The City of Cape Town Climate Change Think Tank: Promoting evidence-based, public decision-making through research**

In 2009 the City of Cape Town, in partnership with the African Centre for Cities at the University of Cape Town and Sustainable Energy Africa, established the City of Cape Town Climate Change Think Tank. This initiative undertakes climate change research and involves multiple stakeholders including academics, specialists (climatologists, coastal engineers, hydrologists, economists, etc), and City officials. The primary goal of this initiative is to enable the City of Cape Town to become more proactive in anticipating and adapting to a changing climate and take more informed decisions based on sound research.

One important research area is modelling the impacts of climate change under various scenarios, using the Salt River Catchment, one of the major catchments within the City, as a case study. Under conditions of high rainfall, as witnessed in July 2007, the Salt River Catchment poses a serious flood risk to city residents and businesses. Floods in the Catchment are mainly attributed to inappropriate development, river canalization and destruction of flood-attenuating wetlands. A climate change model was developed to assess potential impacts due to coastal storm surges, sea level rise, increased rainfall and run-off, and the role of the interaction between freshwater and marine systems in amplifying disaster risk under different scenarios. Research results helped identify current as well as future areas at high risk, which will enable City officials to strengthen coping capacities and make more adaptive development decisions. Due to its successful application, the methodology will be replicated for other catchments in the City. This initiative has demonstrated the value of partnering with academia and civil society in providing local government with technical assistance on which to base planning decisions.

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<sup>1</sup> The ISDR Cities Campaign outlines 10 essentials for making cities resilient, of which Checklist No. 8 states: “Protect ecosystems and natural buffers to mitigate floods, storms surges and other hazards to which your city may be vulnerable. Adapt to climate change by building on good risk reduction practices”. This policy brief aims to enhance implementation under this priority area.

<sup>2</sup> United Nations Population Division. 2008. *World urbanization prospects: The 2007 revision*. New York: UN Department of Economic and Social Affairs, Population Division.

<sup>3</sup> International Federation of the Red Cross and Red Crescent Societies (IFRC). 2010. *World disasters report 2010: Focus on urban risk*. Geneva: IFRC.

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

<sup>6</sup> Government of Fiji, Ministry of Provincial Development and Multi-Ethnic Affairs. 2009. “Good practices in Fiji flood management”. Expert group meeting on innovative strategies towards flood resilient cities in Asia-Pacific. Bangkok, Thailand. 8 pp. (Downloaded from [http://www.unescap.org/idd/events/2009\\_EGM-DRR/EGM-FIJI-PAPER.pdf](http://www.unescap.org/idd/events/2009_EGM-DRR/EGM-FIJI-PAPER.pdf), on 15 March 2011).

<sup>7</sup> Holland, P. 2009. *Nadi Floods: Economic costs of the January 2009 floods*. Suva: SOPAC. Technical Report 426.

<sup>8</sup> Lal, P.N and Sobey, M.N. Managing watersheds for urban resilience: Cost of business as usual and ecosystem-based flood risk management challenges in the Nadi Basin, Fiji. IUCN Oceania Regional Office.

<sup>9</sup> Lal, P. N. 2010. “Vulnerability to natural disasters: An economic analysis of the Fiji 2009 floods on the Fijian sugar belt”. *Pacific Economic Bulletin* 25(1): pp. 62-77.

<sup>10</sup> Lal, P.N and Sobey, M.N. Managing watersheds for urban resilience: Cost of business as usual and ecosystem-based flood risk management challenges in the Nadi Basin, Fiji. IUCN Oceania Regional Office.

<sup>11</sup> Platt, R.H. 2006. “Urban watershed management. Sustainability, one stream at a time”. *Environment*. Vol.48, No.4: pp. 26-42.

<sup>12</sup> US Environmental Protection Agency, Watershed Academy Web ([www.epa.gov/watertrain](http://www.epa.gov/watertrain))

<sup>13</sup> Water World (US). 18 March 2011. “Forests are key for high quality water supply / Better forest management needed to maximize water-related benefits from forests.” See also, Dudley, N. et.al. 2010. *Natural solutions: Protected areas helping people cope with climate change*. Gland, Switzerland, Washington, DC and New York, USA.: IUCN-WCPA, TNC, UNDP, WCS, The World Bank and WWF.



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