USAID BIODIVERSITY AND DEVELOPMENT HANDBOOK

IV BIODIVERSITY AND DEVELOPMENT INTERSECTIONS

Families rest in the shade while Northern Rangelands Trust community rangers pass by on patrol in Kenya. Nature-based enterprises and improved management earned about $1.3 million in 2013, in an area with low annual incomes and few economic options.

Photo: Juan Pablo Moreiras, Fauna & Flora International

IV BIODIVERSITY AND DEVELOPMENT INTERSECTIONS

Fishermen of the Hail Haor wetland in Srimongol, Bangladesh, have much to celebrate. After USAID helped local people participate in decision making and management of Hail Haor, fish diversity went up significantly, waterbirds that hadn't been seen for years returned, and fishermen regularly caught more fish in less time than they used to. This success with community co-management led the Government to change national policy on the rights of communities and initiated a large scale up in effort with USAID support.

Photo: Sirajul Hossein

IV BIODIVERSITY AND DEVELOPMENT INTERSECTIONS

4.0 OVERVIEW

This chapter supports Goal 2 of the Biodiversity Policy, "integrate biodiversity as an essential component of human development," as well as Agency integration goals and emerging best practices. Virtually all USAID programs are integrated with other sectors, whether intentionally or not, because they operate within socioeconomic systems. Biodiversity conservation programs are no exception. Conservation activities impact other sectors and vice versa. This chapter provides information on these linkages and impacts, for consideration in increasingly common multi-sector programming. Programmers and managers may also find this information useful in considering how working in different sectors contributes to sustainability. In addition, biodiversity and environment experts need to know enough about other sectors to be able to engage appropriately, though they do not have to be experts.

Integration does not mean doing everything; it means being strategic. Resources presented in this chapter can help planners make these strategic choices – identifying entry points and actions in other sectors that can lead to and enhance biodiversity conservation outcomes. For example, in the context of a threats-based approach, planners and practitioners could engage with efforts to strengthen legal and justice systems and apply best practices to specific conservation challenges such as trafficking or illegal, unreported, and unregulated (IUU) fishing.

As explained in Chapter 3, it is also evident that conservation approaches require knowledge about and engagement with the sectors to be covered here. Broad-scale landscape and seascape approaches often dictate integration of agricultural considerations; these could involve a mix of ecoagriculture, agroforestry, and intensification techniques, as well as improved fisheries management in seascape settings. Community-based natural resource management (CBNRM) approaches can improve conservation impacts and results by incorporating and facilitating the positive evolution of land tenure and property rights concerns. Similarly, many practitioners are increasingly realizing the importance of governance in biodiversity conservation programs: Integration of such basic principles as transparency and accountability can lay the foundation for more equitable, positive, and sustainable results. Finally, the crosscutting issue of global climate change has profound implications for natural resource management (NRM) and the conservation of biological diversity. Integrating climate change adaptation measures into conservation programs will be a necessity. At the same time, healthy and diverse ecosystems will provide resilience to climate change for other sectors.

4.6 WATER RESOURCES

4.6.1 Freshwater and Biodiversity

Definition and Significance

Freshwater ecosystems cover a wide range of systems, including lakes, ponds, rivers, streams, springs, headwaters, wetlands, deltas, and floodplains, among others. Freshwater diversity includes the species that depend upon freshwater ecosystems for one or more components of their life cycles, including plants, insects, amphibians, reptiles, fishe, crustaceans, mammals, and birds.

There are some important concepts related to the anatomy of aquatic systems. The headwaters area is the area at which a river begins. This area might include a wetland, a natural spring, a lake or pond, or a series of small tributaries in a mountain forest. Riparian areas are the areas along a river or stream; these are especially important for maintaining water quality, reducing sedimentation, and regulating water temperature. Flow is the amount of water that runs in a river or stream; it includes two aspects: the volume and seasonal timing of water and the pattern of movement, which can be altered by dams and channels. Wetlands are lands that are inundated by water for at least a portion of the year.

They range from ephemeral wetlands that last a few weeks to permanent wetlands that are permanently covered by water. Floodplains are low-lying, flat areas adjacent to rivers, lakes, and coastal areas that frequently experience, and are particularly adapted to, periodic flooding. Estuaries are semi-enclosed bodies of water that have a free connection with the ocean but are considerably less saline. The mouth of a river, or delta, is where a river runs into an ocean, lake, or wetland; these areas are typically rich in nutrients and thus very high in biodiversity.

Water is the basis of all life on Earth. Although fresh water makes up only 3 percent of the world's available water, only 1 percent of this 3 percent of total water is available and suitable for drinking water. Moreover, freshwater bodies cover only about .8 percent of the Earth's surface, but freshwater ecosystems support nearly 6 percent of all species ever described, and extinction rates are four to six times higher for freshwater species than for terrestrial species. Fresh water plays a key role in every aspect of human life, including those that are most essential: drinking water, food, and sanitation. Poor people, in particular, depend upon the goods and services provided by freshwater ecosystems, including for their subsistence and livelihoods. **An estimated 2.8 billion people are expected to face serious water shortages by the year 2025**.

Freshwater ecosystems and the biodiversity they contain are declining faster than almost all other ecosystems globally. More than half of the world's wetlands have been lost in the past century alone, and a large percentage of threatened and endangered species are aquatic.

Key Questions

What are key types of threats to freshwater biodiversity?

Just as with threats to terrestrial biodiversity, there are a wide variety of stresses on and threats to freshwater biodiversity. The most important threats include

pollution – Water pollution includes chemical and nutrient run-off and effluent from households, farms, and businesses. One of the most difficult threats to tackle is non-point source pollution, which includes pollution, such as run-off from farms, which emanates from numerous sources that are difficult to pinpoint, detect, and regulate. In areas with high levels of air pollution, water bodies are also vulnerable from acidification.

fragmentation – Fragmentation occurs when dams, dikes, and levees are constructed, whether for water supply, flood control, or hydro-electricity. The vast majority of the world's major river systems have been dammed. Fragmentation poses an especially significant threat to migratory fish species, such as salmon.

alteration of hydrological regimes – Fragmentation is not the only threat resulting from the construction of dams; the regulation of water flow results in altered hydrological regimes, such as timing of seasonal floods. The channelization of rivers and streams, and dredging of stream and river bottoms, can also result in altered hydrological regimes, which can be just as important as fragmentation for many aquatic species, affecting their ability to reproduce at key points in their life cycles.

sedimentation – Changes to riparian ecosystems, such as through intensive logging, can result in sedimentation and siltation downstream, with huge impacts on aquatic biodiversity.

conversion of wetlands – Because wetlands can easily be converted to other land uses by dredging and filling, and because they are traditionally undervalued, they are especially susceptible to conversion to other land uses, including transportation and industrial and residential infrastructure.

invasive alien species – Freshwater systems are vulnerable to a variety of invasive alien species, such as mussels, snails, parasites, fish, snakes, and aquatic plants. These species can easily spread from one water body to the next, and one country to the next, through multiple pathways, including transportation.

What are some emerging social and political dimensions in freshwater management?

Some key emerging issues in water management include political conflicts, gender issues, and water security. Although these issues do not directly involve biodiversity, they can be either exacerbated by mismanagement of biodiversity and aquatic ecosystems or mitigated by sustainable natural resource management practices.

conflict – Water is a source of conflict in many regions of the world. More than a billion people do not have adequate supplies of drinking water. This number will continue to grow; as stated above, some studies predict that by 2025, two-thirds of the world's population will face water shortages. Water conflicts may take several forms, including control of water resources and use of water as a political tool, military target, or instrument of terrorism. Although there are few direct wars over water, and water conflicts have been relatively mild in the past, water-related issues have often aggravated existing conflicts. With increasing pressure on freshwater resources, and with many countries sharing the same water sources, an increase in water-related conflicts is likely to occur in the future. Areas of particularly acute water conflicts include the Jordan River Basin and the Tigris-Euphrates Basin in the Middle East; the Nile, Volta Niger, and Zambezi Basins in Africa; and the Indus River Basin in Asia.

water security – National water security is defined as the ability of a country to reliably secure an adequate quantity of sufficiently high-quality water to meet the needs of its population. Water security is threatened around the world primarily by three factors: diversion of rivers toward competing uses (either within or across national boundaries); unsustainable water management practices, such as the depletion and/or salinization of aquifers and unsustainable consumption; and inappropriate land management practices that do not adequately protect headwaters, riparian buffers, and water-recharge areas.

gender – In many cultures, women are largely responsible for agricultural work, home sanitation, food preparation, and childcare. All of these are water-intensive activities. In many regions of the world, women spend more than a quarter of their time and daily calories collecting water. In India alone, this adds up to 150 million work-days per year that are lost to water collection. In addition, access to clean drinking water is essential to maintaining the health of children, particularly in developing countries, and this role also primarily falls to women. Therefore, access to sufficient water is widely recognized as a key gender issue.

How will climate change affect freshwater resources and what can managers do about it?

Climate change impacts are most noticeable through changes in precipitation, including increased frequency and intensity of storms, floods, and drought. Studies suggest that weather-related disasters involving water (e.g., floods, drought, and storm surges) have increased three-fold over the past three decades and will continue to increase in the future. These threats are felt most severely in developing countries and can be mitigated to some extent by effective ecosystem management that focuses on principles of climate resilience and adaptation. Examples of managing freshwater ecosystems for climate resilience, adaptation, and mitigation include

riparian and headwater forests – Forests, particularly riparian and headwater forests, help regulate water flows and maintain water quality. Nearly half of the world's largest cities obtain a significant portion, if not all, of their water from protected or managed forests. Maintaining high-quality forests is the first step toward maintaining water supplies during times of drought, which are likely to be exacerbated by climate change.

wetlands and floodplains – Wetlands are a natural water-treatment system and ensure regular flows of clean water in times of both drought and flood. Floodplains enable human communities to adapt to more frequent and intense rainfall events by absorbing large volumes of water. Managers can help strengthen resilience of both areas by reducing threats to wetlands, maintaining key structures and ecological processes, and designing and managing wetland areas to withstand weather events that are more frequent and intense than historical norms.

rivers – Managers can strengthen river resilience by maintaining natural hydrological flow regimes; increasing connectivity; and reducing key threats that lower resilience, such as removing invasive alien species, restoring degraded riparian areas, and reducing pollution and siltation.

peatlands – Peatlands cover less than 4 percent of the world's terrestrial area, yet they contain up to a third of the Earth's terrestrial carbon and store more than double the amount of carbon stored in the world's forests. Peatlands found in Indonesia, the Amazon, and the Congo Basin harbor major forest biodiversity.

Managers can ensure that peatlands continue to be a carbon sink rather than a carbon source by avoiding peatland dredging, draining, and drying out.

Why is economic valuation important to freshwater biodiversity?

Economic valuation is the assigning of economic values (usually measured in monetary figures) to the ecological services provided by an ecosystem. Numerous studies on the economic valuation of ecosystems have been conducted over the past decade, many of which have focused on the vital services that freshwater ecosystems provide, including the provision of clean water and flood control. The total value of services provided by wetlands has been estimated to be as high as $15 trillion annually (MEA, 2005).

Yet these benefits are often hidden, and not well incorporated into full cost accounting and decision-making processes. Economic valuation studies reveal the hidden costs and benefits of ecosystem services and can help decision makers recognize and capture the value of these services, often through a payment for ecosystem services (PES) scheme. Proliferating watershed markets allow downstream users to pay for the costs of conserving water sources upstream. Nearly 300 such markets have been identified, and the number continues to grow (Stanton et al., 2010).

Increasingly, economists not only focus on the value of ecosystem services but also calculate the infrastructure costs that are avoided by maintaining freshwater ecosystems. According the Environmental Protection Agency, maintaining the Congaree Bottomland Hardwood Swamp in South Carolina helped to avoid a $5 million wastewater treatment plant; protected forests in the Catskills of upstate New York helped avoid $6 billion in construction costs and $300 million in operating costs annually for a water-filtration system; and restoring the 100-year flood zone of the five-state Upper Mississippi River Basin could store 39 million acre-feet of floodwaters – the same volume that caused the Great Flood of 1993 – and save over $16 billion in flood-damage costs.

BOX 61. AN EXAMPLE OF A PAYMENT FOR WATERSHED SERVICE IN ECUADOR

An example of a payment for watershed service is the Quito Water Fund (FONAG) in Ecuador, a trust fund established with USAID technical assistance over several years for the protection of the watershed providing Quito's drinking water supply. The quasi-public municipal drinking water and electrical utility, a private brewery, and a water bottling company committed resources through an 80-year trust fund mechanism created through local financial regulations. To date, FONAG has generated an endowment of $6 million and provides $800,000 a year for conservation efforts that involve strengthening upstream watershed parks and protected areas providing water quality protection to the city's municipal water supply. Payments support rural families in restoring degraded lands and adopting sustainable farming practices, reforestation, and educating children about sustainable water management. From 2000 to 2008, USAID invested US $2.3 million and leveraged an additional US $7 million of fund revenue to support key conservation and watershed protection activities through FONAG. The Quito model is now being replicated for many Andean cities (Stanton et al. 2010).

In the future, economists will likely place even more importance on the economic value of freshwater ecosystems, particularly as the full brunt of climate change impacts begins to be felt. From 2000 to 2006, more than 2,100 water-related disasters were reported globally, killing more than 290,000 people, affecting more than 1.5 billion, and inflicting damages worth more than $422 billion (Adikari and Yoshitani, 2009). Given that the World Bank estimates the total costs of adaptation to be between $71 and $82 billion, there is little doubt that governments will soon want to begin to assess the economic value of freshwater ecosystems, particularly their role in enabling societal adaptation to climate change.

4.6.2 Freshwater Systems and Conservation Planning

Definition and Significance

As described earlier in this handbook, conservation planning is defined as the deliberate process of identifying priorities for taking conservation action. Freshwater conservation planning entails planning for the conservation and protection of freshwater species; natural communities; and ecosystems at a variety of scales, including site, ecoregion, watershed, and national levels.

The vast majority of conservation planning processes that have taken place around the world have focused on either terrestrial or marine biodiversity. There have been very few systematic efforts to incorporate freshwater biodiversity into ecoregional- and watershed-scale planning processes. Yet freshwater processes and dynamics are often very different from terrestrial ones. Terrestrial ecoregions are dramatically different from freshwater ecoregions,[1] and the primary unit for freshwater planning is often the drainage unit.

Figure 18 shows South American ecological drainage units based on geomorphic and climatic attributes (TNC, 2007). This section outlines a process by which planners can incorporate freshwater aspects into conservation planning at ecoregional and watershed scales.

Key Questions

How can planners incorporate freshwater biodiversity into broad-scale conservation planning?

Just as terrestrial biodiversity is divided into realms, biomes, ecoregions, landscapes, and ecosystems, freshwater biodiversity can be divided into classification units that help planners better capture it in their planning efforts. Higgins, et al. propose a four-tier classification system that includes a) an aquatic zoogeographic unit, or basin; b) an ecological drainage unit; c) an aquatic ecological system within an ecological drainage unit; and d) microhabitats within aquatic ecological systems.

1 See, for example, the freshwater ecoregions defined by WWF and compare with their terrestrial ecoregions.

Figure 18. South American Ecological Drainage Units Based on Geomorphic and Climatic Attributes (TNC, 2007)

Reprinted by permission. Petry, Paolo and Leonardo Sotomayor. Mapping Freshwater Ecological Systems with Nested Watersheds in South America. The Nature Conservancy: 2009.

Key variables in defining an aquatic ecological system include stream size and gradient, stream and lake elevation, stream and lake geology, hydrological regime, lake size, lake drainage, lake drainage network position relative to species connectivity requirements, and lakeshore complexity. These factors allow planners to develop conservation plans that better capture the nuances and complexities of freshwater biodiversity. Once these factors are defined, planners can incorporate them into the same kinds of systematic conservation planning processes and models as used in terrestrial planning, including Marxan and other software programs.

What is an example of incorporating freshwater biodiversity into broad-scale conservation planning?

In South Africa, planners used generic conservation planning software and applied it to the freshwater ecosystems and planning units that were particular to freshwater ecology (Rivers-Moore et al., 2011). They began by identifying priority primary catchments, and then selected priority sub-catchments for finer-scale planning. The team identified significant biodiversity for the freshwater systems by focusing on key estuaries, free-flowing rivers, highly intact areas, and important catchment areas. They added additional features by focusing on upstream-downstream connectivity and identifying migratory aquatic species, such as eels and fish. As with terrestrial conservation planning, they incorporated existing protected areas into their analysis.

What are some key challenges in planning for freshwater biodiversity conservation?

Planners face numerous challenges when planning for freshwater biodiversity conservation. Much of freshwater biodiversity has yet to be classified. As a result, planners often rely upon biodiversity surrogates, rather than actual biodiversity data. The reliability of these surrogates has yet to be tested. The selection of focal species in freshwater conservation planning has not yet reached the same level of maturity as in terrestrial planning. Integrating the results of freshwater, marine, and terrestrial planning can be difficult, and there are multiple conservation tradeoffs that must be made. In addition, the process of planning for freshwater connectivity is still largely uncertain; connectivity requirements are clear for some anadromous fish species but are far less so for other freshwater species. Finally, the process for and key principles of planning freshwater ecosystems for climate resilience are still in their infancy.

4.6.3 Integrated Planning for Watersheds, Estuaries, and Coasts

Definition and Significance

Several interrelated concepts are involved in managing freshwater biodiversity in a coordinated fashion across broad scales.

The issue of integrated water resources management is an increasingly important focus of USAID's work. Defined as "the coordinated development and management of water, land, and related resources in order to maximize economic and social welfare without compromising the sustainability of ecosystems and the environment" (Global Water Partnership), integrated water resource management is a critical process. It helps to avoid unsustainable rates of water use; address problems between competing water uses (including for drinking water, livestock, agriculture, industry, and energy); and promote better cooperation and coordination across multiple sectors.

The concept of integrated coastal management is also important. Defined as a dynamic planning process that encompasses the sustainable use, development, and protection of coastal, nearshore, and marine areas, integrated coastal management is a well-established process in many countries. But integrated coastal management planning processes often do not address inland issues within watersheds. A "ridge-to-reef" approach tries to create a planning framework for uniting inland waters with integrated coastal management. See Chapter 3, Section 3.2.3, for more details on ridge-to-reef approaches.

What are some basic principles of integrated water resource management?

Integrated water resource management is a widely recognized planning approach. Broad consensus exists on some of its basic principles, including

- a focus on coordination among multiple stakeholders
- a simultaneous focus on economic and social welfare, equity, and biodiversity protection
- an understanding of the interconnectedness of catchments, coastlines, estuaries, and land use practices at multiple scales

- an understanding of the potential for conflicts and tradeoffs between various stakeholder groups
- the use of scientific data as the basis for decision-making
- an emphasis on good governance and democratic participatory processes

What are some practical steps toward integrated water resource management?

A recent USAID guide highlights a series of practical, concrete steps that planners can take to put integrated water resource management principles into practice. These include

identifying key issues and building constituencies – understanding the historic and predicted water flows, threats, and uses; identifying stakeholders and their concerns; evaluating potential future impacts of uses on the freshwater ecosystems; assessing the existing management system

formulating integrated water resource management policies and strategies – setting goals with stakeholders, conducting targeted data collection and research, developing potential scenarios, and experimenting with potential plans to determine potential outcomes

negotiating and formalizing goals, policies, and institutional structures – getting formal endorsement of policies by major stakeholder groups, selecting an institutional structure for implementing integrated water resource management policies, and securing the required funding

adaptively implementing the integrated water resource management program – assessing the degree to which the preconditions of effective implementation have been met, encouraging voluntary compliance with agreements, and monitoring results

evaluating the program and learning from the results – assessing the quality of the program execution and evaluating social and environmental impacts

What are some examples of integrated water resource management actions?

improving institutions and policies for water resource management – USAID has helped develop new mechanisms for better coordination and stakeholder participation and assisted in the development of new policies on key water issues.

developing best practices in water resource management – USAID can help identify best practices, then encourage the diffusion and adoption of these technologies and practices throughout the country.

increased NGO participation in water resource management – USAID has helped NGOs and community-based organizations increase their capacity to participate in water resources management. The Agency has also supported public-awareness and outreach campaigns.

4.6.4 Wetlands and Biodiversity

Definition and Significance

The Ramsar Convention on Wetlands defines wetlands as "areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters." Wetlands may include lakes, rivers and marshes, nearshore marine areas, and human-made wetlands, such as reservoirs.

Wetlands harbor extraordinary levels of biodiversity. Because wetlands are remarkably productive ecosystems, they provide an unusually large number of benefits and services. The Millennium Ecosystem Assessment for Wetlands listed dozens of services, including

food production: fish, wild game, grains

fresh water: for domestic, industrial, and agricultural uses

fuel: production of peat

climate regulation: carbon sink

water regulation: groundwater recharge and discharge

water purification: removal of excess nutrients

natural hazard regulation: flood control and storm protection

habitat: highly diverse ecosystems

As a result of these services, wetlands have enormous value to society. One study found that for the Muthurajawela Wetland in Sri Lanka, the economic value exceeded $7.5 million; for the Lake Chilwa Wetland in Malawi, it exceeded $21 million; for the Wadden Sea in the Netherlands, it exceeded $2.3 billion; and for the Pantanal Wetland in Brazil, it exceeded $15.6 billion. Despite the extraordinary economic, social, and ecological value of wetlands, they are among the most-threatened ecosystems in the world, and poor consideration of these values is the leading cause of their loss and degradation. Integrated wetland assessments can help identify the economic, social, and ecological values of wetlands and foster better societal decisions about wetland management.

Key Questions

What is an integrated wetland assessment and why is it important?

Because the economic, social, and ecological values of wetlands are so inextricably intertwined, a broader, integrated assessment is often required. A recent guide by IUCN (Darwall et al., 2007) describes the process of integrated wetland assessment, with examples of key elements to be included:

physical wetland – the geology and topography and hydrological regime

biodiversity and ecosystems – the wetland ecosystem-specific species and their ecological context, and ecological processes

ecosystem services – the full range of values, benefits, and services, including water provisioning and regulation, food, and flood control

local livelihoods – agriculture, fisheries, and products that flow from the wetland

policies, governance, institutions, and markets – markets, fisheries policies, and protected area management and land use patterns

Together, these elements can be combined into a conceptual synthesis, which in turn can lead to an integrated management plan that addresses each of the issues above.

What is an example of integrated wetland assessments?

One example of an integrated wetland assessment is from Mtanza-Msona, Tanzania (Campese, 2008). In this assessment, planners held a series of national and local dialogue meetings, followed by a national roundtable discussion. Key findings included the following:

- All households used a variety of wetland resources for their subsistence and livelihoods.
- Wetlands provided substantial economic value to the village as a whole (about $100 per capita).
- The poorer households had a heavier dependency on the wetland in order to spread household risk.
- The vast majority of village economic activities depended on the wetland.
- Some wetland species had a disproportionate importance for local livelihoods, while others were more important ecologically.

The existing management framework was inadequate to incorporate these issues and needed to be upgraded to accommodate the multiple benefits, challenges, threats, and opportunities revealed by the integrated wetland assessment.

What is mainstreaming of wetland biodiversity and why is it important?

Conducting an integrated assessment of wetlands is an important first step. In order to ensure that the values of wetlands are fully recognized by society, however, planners will need to take the next step – integrating and mainstreaming these values into broader sectoral plans and policies. Mainstreaming can be defined as the full internalization of biodiversity conservation and sustainable use goals and objectives into the daily management practices and policies of production sectors. Examples of sectors that influence and/or depend upon wetlands include agriculture, land use planning, water management, tourism, forestry, energy, and climate change planning.

What are some examples of mainstreaming of wetland biodiversity?

There are several examples of effective mainstreaming of wetland biodiversity into sectoral plans, policies, and practices, including

Mexico: One of Mexico's main development challenges is the availability of water – 32 percent of the country's natural water is located in central and northern Mexico, where 77 percent of the population lives and 88 percent of the gross domestic product is generated. The number of depleted aquifers has jumped from fewer than 20 in the 1970s to more than 100 in 2006. The focus of mainstreaming efforts, supported by WWF and the Government of Mexico, has included

improving sectoral awareness – promoting awareness of the functions and services of freshwater and wetland ecosystems, especially in the land use and water management sectors

strengthening governance – supporting the consolidation of water governance across many sectors within each basin

assessing and incorporating the economic values of wetlands – determining the economic values of environmental services and products, incorporating these values through demonstrative projects, and promoting the results of these projects widely

promoting sustainable resource use – strengthening the capacity of rural and indigenous communities to improve sustainable use of ecosystems, particularly sustainable forestry and agriculture

securing water rights – ensuring that indigenous and rural communities with populations under 2,500 had secure water rights for domestic and productive activities

Cameroon: In Cameroon, African coastal mangrove forests cover 3.9 million hectares and are of enormous economic and ecological significance to the country. For decades, these mangrove forests have been facing threats from harvesting of timber, fuel wood, non-timber forest products, and artisanal fishing. Efforts to address these threats have focused on the dual aims of biodiversity conservation and poverty alleviation. Specifically, wetlands and poverty mainstreaming efforts have included

mangrove and wetland restoration – restoring key mangroves and wetlands, while building efforts for poverty alleviation through sustainable harvest of non-timber forest products

value-added processing of wetlands products – improving methods of drying fish by building 50 community fish smoking buildings

land use planning and gazetting – improving participation in the land use planning process and creating community-use zones adjacent to core conservation areas

ecotourism development – promoting ecotourism, specifically to the international bird-watcher community

forestry and tenure policies – revising forest-clearing policies that allowed for the clear-cutting of mangroves, and helping to resolve ambiguous land tenure policies that promoted unsustainable practices

Community members restore coastal mangrove forests near Davao City in the Philippines. Mangroves are biodiversity hotspots, acting as nurseries for a variety of marine fish and invertebrates with local and/or commercial value. They also help mitigate and adapt to climate change by sequestering carbon above and below ground and shielding coastal communities from more frequent or intense storms, especially as sea levels rise.
Photo: DAI

4.6.5 Water Supply, Sanitation, and Hygiene (WASH)

Definition and Significance

"Water supply," "sanitation," and "hygiene" (WASH) (see Box 62 for definitions) constitute a suite of basic services that are fundamental to human well-being and development. Providing more of the world's population with WASH services is a declared Millennium Development Goal, and access to water supply and sanitation was recently acknowledged by the United Nations as a basic human right. Despite this high-level attention, it is estimated that 2.5 billion people around the world still lack access to improved sanitation, and over 780 million people, primarily in sub-Saharan Africa and South Asia, do not have access to improved drinking water sources.

Sustainable and equitable access to water supply and sanitation services and adoption of critical hygiene behaviors are important enablers of a broad range of development benefits. WASH investments improve health and save lives, especially those of children under 5, about 760,000 of whom die from diarrheal-associated causes every year. When safe household water supply is reliably accessible, food security and nutrition are also improved. Girls have better opportunities for education, and women are less burdened in the home. Secure and sustained access to domestic water expands options for livelihood strategies for both men and women and facilitates broad-based economic development. WASH is a good investment, as well; the World Health Organization has estimated that economic benefits associated with WASH total $3-34 for every dollar invested.

Underpinning these benefits are numerous important linkages between WASH and the natural environment, including the conservation of biodiversity. The integrity of ecosystem processes is, in fact, a key supporting element for the provision of sustainable WASH services. At the same time, carrying out WASH activities in an environmentally responsible way is essential for protecting ecosystems and biodiversity. These intersections occur both "upstream" and "downstream" of the WASH services. Domestic water supply and water-based sanitation depend on the availability of steady, reliable, and clean quantities of water from natural sources. "Ecosystem services" associated with the natural hydrologic cycle – including the regulation of water runoff, infiltration, recharge, natural water storage, sediment control, filtering, and purification – ensure the continuous natural supply of this resource for all human uses, including WASH. The economic value of the environmental services provided by such healthy, intact natural systems as high-biodiversity forests, riparian areas, and wetland systems is not trivial. In the well-known case of New York City, a long-term watershed protection scheme has saved billions of dollars by avoiding drinking water filtration and treatment costs over the two decades it has been in place. In addition to drinking-water quality protection, intact and biodiversity-rich ecosystems can provide other services, such as the mitigation of climate change impacts that threaten WASH infrastructure and services (e.g., coastal ecosystems buffering extreme storm events or mitigating sea level rise saltwater intrusion into groundwater supplies).

BOX 62. WASH DEFINITIONS

"Water supply," "sanitation," and "hygiene" can embrace a wide variety of meanings in day-to-day conversation. Not all of these meanings align with the technical definitions most accepted in the international WASH community, however. International WASH initiatives, such as are included in the Millennium Development Goals (MDGs), use more precise definitions that should be kept in mind:

- **Water Supply** refers to water services provided primarily for domestic uses, including drinking, cooking, cleaning, laundry, and basic personal and household hygiene. Some productive uses of water may be included, but dedicated water supply development for agriculture, power generation, or ecosystem use is not included in this definition. "Improved" domestic water supply under the WASH MDG definition implies some degree of "safety," but does not include explicit water quality standards or required treatment.
- **Sanitation** is defined as hygienic management of human feces to reduce the risk of fecal-oral transmission of disease. As a primarily public health-oriented definition in the developing country context, "improved sanitation" has not traditionally required management of human waste collected before discharge into the environment (i.e., wastewater treatment or fecal matter processing). In more recent international dialogues, however, the definition of sanitation has broadened to address the issue of environmental sustainability and appropriate waste management associated with sanitation collection systems. Note that issues such as industrial wastewater management are still not included in these discussions.
- **Hygiene**, for most WASH practitioners, refers to specific evidence-based behaviors that are linked to the reduction of diarrheal disease, including hand washing with soap; sanitary feces management; and proper transport, storage, or treatment of household water quality. Increasingly, attention to food preparation and storage is also included as a key hygiene behavior. In addition, some WASH practitioners include other forms of personal hygiene, such as face washing to control trachoma and other water-related diseases, or non-diarrheal disease-related practices, such as menstrual hygiene.

At the opposite end of the WASH services value chain, poorly managed waste from human sanitation systems can pose significant threats to biodiversity downstream, especially near dense population centers. In developing countries, less than 10 percent of wastewater is treated or managed in an environmentally sustainable fashion. Given expected rates of global urbanization, and a shift to more water-based sanitation and sewerage typically accompanying the growth of cities, these volumes are likely to increase dramatically in the future. Discharge of this untreated human waste from urban areas is already having a significant environmental impact. More than 50 percent of global rivers, lakes, and coastal waters are estimated to be seriously contaminated, with bacteriological and nutrient pollution from domestic wastewater a key contributor in some areas. "Dead zones" currently affect more than 245,000 km^2 of marine ecosystems as a result of such contamination. By 2030, more than one-fifth of the global population will be discharging its waste in coastal areas, placing fragile coastal/estuarine ecosystems and biodiversity at even greater risk.

Systems thinking and integrated approaches are essential to addressing both "upstream" and "downstream" WASH and biodiversity linkages. The prevailing management paradigm in the water sector is integrated water resources management (IWRM), which includes WASH and all interconnected users and stakeholders in the governance and management of water resources. Intersections between WASH and biodiversity can be explicitly addressed within the framework of IWRM, including issues of water quantity and quality for human use, as well as the maintenance of healthy ecosystem services.

Key Questions

What are the essential ingredients for strategic integration of WASH and biodiversity programs?

While there has been increasing interest in the integration of biodiversity conservation and WASH programs, not all such efforts are strategic or result in sustainable benefits. Successful integrated WASH and biodiversity programming occurs when the approaches proposed are deemed a priority from the perspective of both the WASH and biodiversity sectors, and when the implementation of such approaches demonstrates equal or better development results than stand-alone programming in each area. Guiding principles include the following:

"Do no harm" to either sector – e.g., by ensuring that human waste from WASH systems is managed properly before discharge into the environment, or that investment in ecotourism or other natural resource-based livelihoods to conserve biodiversity does not result in domestic water shortages for communities.

Adhere to state-of-the art technical approaches in both sectors. The provision of one-off, individual community WASH systems, employed as an entry point for rural community NRM governance, is not generally considered to be either sustainable or transformative by WASH practitioners. Conversely, focusing biodiversity programs specifically on WASH-related ecosystem services (either upstream or downstream) may not be seen by biodiversity specialists as the most critical way to reduce threats to a country's high-value biodiversity areas. However, with some modest compromises and strategic pooling of resources on each side, synergies can often be found that are strategic from both points of view.

Engage appropriate technical expertise in both sectors. Much of the justifiable criticism of integrated programs has occurred when WASH or biodiversity specialist organizations attempt to design and/or implement programs in the other sector. Environment NGOs often construct water points or train community WASH committees without a core expertise in this area, while WASH NGOs may add on environment-sector activities without the necessary technical capacity in this area. Demonstrated multi-sectoral expertise should be present starting in the design stage of the program and continue throughout implementation and follow-up; this may require engaging more than one implementing organization.

What are some of the most common examples of strategic integrated WASH and biodiversity activities?

Successful integrated WASH and biodiversity programs support a variety of policy tools, technical approaches, and market mechanisms to simultaneously keep ecosystems healthy and ensure the sustainable delivery of WASH services. The Africa Biodiversity Consultative Group (ABCG) provides a valuable resource based on an expert workshop for integrating WASH with freshwater conservation and biodiversity. See Box 63 for tips on applying biodiversity funding earmarks to WASH activities.

Common strategic approaches seen in successful integrated WASH and biodiversity programs include

water resources and watershed management to protect source water supplies for WASH services and healthy ecosystems – There is increasing recognition among WASH practitioners that protecting the quantity and quality of source water in nature is a fundamental component of sustainable and resilient domestic water and sanitation service delivery. Biodiversity advocates also recognize the value of conserving high-value ecosystem services provided by important river basin systems, most of which also provide a supply of drinking water and assimilate sanitation waste. Integrated strategic approaches may include reduction of threats to ecosystem services in upper catchments that specifically protect drinking water quality (such as WHO's "Water Safety Plan" approach) or multi-stakeholder, participatory governance of water resources and services at the scale of the watershed, catchment, river basin, or aquifer. Managing domestic water supply extractions to ensure that there is no adverse impact to natural flow regimes or the ability of hydrologic systems to produce food, cycle nutrients and sediments, and maintain critical wetland and estuarine habitats is also important. These integrated activities are most appropriate in defined water catchments with documented high-value ecosystem services that also provide surface water supply to a population center. (See Box 64 on water safety planning in the Philippines.)

economic valuation of environmental services – Economic valuation of ecosystem services that benefit people can be an effective tool to advocate for the importance of investing in biodiversity conservation. It also provides an incentive for promoting policy and legal reforms for both environmental and human health. A significant portion of the monetary value assigned to ecosystems worldwide is associated with water and watershed-related benefits. "Beneficiaries" of these services can be downstream consumers of drinking water supply, as mentioned above. At the other end of the spectrum, businesses and industries in valuable coastal and marine habitats, including tourism and fisheries, can also be recipients of ecosystem benefits derived from upstream urban areas that treat domestic wastewater. In selected contexts, there are opportunities to convert this value into financial support in the form of payments for environmental services (PES)/payments for watershed services (PWS) that transfer funds from the recipients to the providers of ecosystem services. More than 100 of these schemes are currently operating around the world in association with municipal drinking water supply, primarily in Latin America (e.g., in Quito, Ecuador and Bogotá, Colombia). While promising in some settings, operationalizing such schemes is difficult in practice, and many barriers remain, including lack of technical and market information, limited institutional experience, inadequate legal framework, limited successful business models, and equity concerns.

improved management of excreta and domestic wastewater to reduce threats to sensitive freshwater and marine aquatic habitats – The design and implementation of WASH programs must follow USAID environmental compliance regulations to mitigate environmental externalities associated with these activities. This starts with the immediate impacts of construction of water and sanitation infrastructure that might affect ecosystem functions (e.g., vegetation clearing, damage to riparian or wetland habitats, alteration of river flows, and soil erosion at construction sites). The long-term environmental impacts of waste management are also priority areas of intervention. Numerous wastewater treatment options are available, including decentralized constructed wetlands and other lower-technology/lower-cost approaches. For household or institutional latrines, there are several "ecological sanitation" options available that compost waste on-site. Increasingly, technologies are being developed that view excreta as a useful resource, rather than simply as a waste disposal problem. These technologies are creating closed-loop systems that transform human waste into a valuable community asset such as fertilizer or energy. (See Box 65 on wastewater management and marine conservation in the Caribbean.)

provision of basic WASH services as an entry point to other development issues – Poverty, environmental degradation, poor human health, and the lack of basic WASH services often coexist, especially in remote rural areas, and there has been some positive experience in co-programming these sectors to achieve development outcomes at a more efficient cost. From a community buy-in perspective, access to WASH services is often a much higher local development priority than the conservation of biodiversity or environmental protection. Biodiversity programs can productively collaborate with WASH partners as a way to engage and organize local residents in a broader range of governance and development issues. Likewise, biodiversity programs that include livelihood components and WASH programs can find productive and mutually beneficial ways to partner through the development of multiple use water services that provide community water supply for both domestic and small-scale productive uses. As mentioned earlier, care must be taken to ensure that any such co-programming is done as part of a systemic and strategic investment in sustainable WASH services at scale, not merely as a "wrap-around" activity for NRM, or water and sanitation services are unlikely to remain operational over time.

BOX 63. WASH AND BIODIVERSITY: TIPS FOR APPLYING USAID FUNDING EARMARKS

When considering options for integrated programs that include both WASH and biodiversity components, careful attention must be paid to the requirements associated with both the USAID biodiversity earmark and the USAID water earmark (as well as any other potential sources of funding used for either). Some things to keep in mind:

- Biodiversity earmark funds can only be used for the direct provision of WASH services in rare instances, e.g., the construction of WASH facilities for visitors in national parks. (Use of water earmark funds for this purpose would be technically eligible but not considered particularly strategic from a WASH systems point of view.)
- The water earmark generally only permits a partial attribution to water resources management activities, so would need to be pooled with other funding sources (potentially including the biodiversity earmark) to support an integrated water resources/watershed management activity.
- To partially attribute biodiversity earmark funds for water resources/watershed activities supporting WASH, there must be a clear, documented, and evidence-based cause/effect relationship between reduction of biodiversity threats and the high-value watershed ecosystem services being protected.
- Geographic location is critical to even considering the possibility of successfully integrating biodiversity earmark money with the water earmark or other funds. Strategic approaches supported by the biodiversity earmark must reduce threats in areas of high-value biodiversity. To effectively integrate with WASH activities, these zones of high-value biodiversity must occur on the "upstream" or "downstream" side of the targeted WASH activities.
- Water earmark resources may be used for small-scale treatment of community wastewater or management of fecal matter associated with household sanitation. USAID environmental compliance regulations can provide an important incentive to allocate water earmark funds to mitigate potential pollution or other impacts associated with WASH programs.
- Both water and biodiversity earmark programs must have an explicit primary or secondary objective and must monitor indicators associated with outcomes in each sector.

BOX 64. WATER SAFETY PLANNING IN THE PHILIPPINES

Most "watershed management" activities prioritize conservation, natural resources management, or poverty alleviation goals, with benefits for downstream drinking water supply sometimes claimed but rarely documented. The World Health Organization (WHO) has developed a methodology that provides opportunities to achieve both conservation and WASH outcomes in selected high-biodiversity watershed settings – water safety planning (WSP). Similar to the threats-based approach used in conservation programming, WSP focuses on identifying and targeting "risks" to drinking water quality along the entire service cycle, from source to consumer. The methodology begins with a thorough assessment of vulnerabilities throughout the service chain. It follows through with development of specific action plans and implementation of multiple preventive "barriers" to contamination. Finally, it institutes a rigorous monitoring and evaluation program to ensure that drinking water quality is maintained to WHO or locally mandated standards.

While much of the WSP methodology is focused on identifying and addressing risks in the physical infrastructure of the water supply or treatment system, one part of the approach requires assessing the condition and state of protection of the natural water source. In the case of surface water-fed systems, there is a specific focus on the important water quality protection services provided by watershed landscapes, one of the most commonly cited ecosystem services and conservation values provided by healthy watersheds.

In recent years, there has been considerable dissemination and testing of the WSP methodology in developing countries around the world. In 2007, the methodology was applied by the Maynilad Water Company 50 km northeast of Manila, Philippines, which is home to a forest surrounding the Ipo Reservoir, one source of the municipal water supply for Manila. The ecosystem is under threat from illegal loggers and charcoal makers, with the resulting deforestation contributing to mudslides and flash floods that put people and settlements at risk and contaminate drinking water supplies. The Maynilad Water Company's WSP has highlighted deforestation as one of the biggest threats to drinking water quality in their system, with the resulting turbidity levels requiring a significant increase in the cost of treatment, as well as maintenance needed to prevent sedimentation blockages.

The village of Sitio Anginan on the shore of the Ipo Reservoir is home to 43 indigenous Dumagat families whose traditional livelihood is derived from farming, fishing, and making charcoal. Following the participatory WSP process, the water company and community worked together to reduce such water-contaminating practices as land clearing around the reservoir, where a vegetated buffer is now in place to reduce sedimentation into the reservoir. Charcoal making has also stopped, with firewood now collected from fallen trees. To compensate for the loss of income, the water company has employed community members to cultivate and plant tree saplings for reforestation and provide protection of the forest from damaging activities. The discipline and rigor of the WSP process has also had broader benefits, including capacity building to improve water company operations and improved governance of both water resources and services through the methodology's highly participatory stakeholder planning process. Following the WSP protocol, strict monitoring is also in place by the water company to track the impact on risks to drinking water quality resulting from this and other strategic approaches. (For more information, see www.wsportal.org.)

BOX 65. WASTEWATER MANAGEMENT AND MARINE CONSERVATION IN THE CARIBBEAN

The Caribbean Sea Ecosystem Assessment (CARSEA) and other studies have found that one of the greatest drivers of degradation of the Caribbean coastal and marine environment is the discharge of untreated wastewater into coastal waters. This threat to the biodiversity of these highly valued ecosystems undermines livelihoods that depend heavily on natural marine resources. Currently, 85 percent of the wastewater entering the Caribbean Sea is untreated, and less than 2 percent of urban sewage in Small Island Developing States (SIDS) is treated before disposal. While wastewater is considered a serious threat by environmental managers and biodiversity conservationists, from a WASH services perspective there has been less commitment, with the global priority focused on access to basic sanitation and sewage collection (not treatment). This has been changing in recent years, as reflected in the current post-MDG Development Agenda consultations, where WASH practitioners have begun to consider management of fecal waste as part of the commitment to sustainable sanitation coverage. Constraints are huge, however, with limited funding for infrastructure remaining a challenge for many governments in developing countries. The political priority of wastewater treatment infrastructure financing is also low. In the Caribbean region in the 1990s, the water and sewage sectors as a whole consistently received the least investment, compared with the energy, telecom, and transport sectors, with very little directed to wastewater treatment.

The Caribbean Regional Fund for Wastewater Management (CReW) was established with support from the Global Environmental Facility (GEF) program in 2011. The program, co-implemented by the Inter-American Development Bank (IDB) and the UN Environment Program (UNEP), is testing two different innovative wastewater financing mechanisms in four pilot countries: Jamaica, Belize, Guyana, and Tobago. Projects are selected to address both biodiversity and WASH considerations. Investments must result in a significant improvement in (or reduced further deterioration of) coastal water quality. At the same time, projects must address a high service priority for the wastewater utilities and work to keep project financing costs within ratepayers' ability to pay. Financing mechanisms reflect local financial conditions, regulatory frameworks, and utility capacity and include both revolving fund and credit enhancement models. The program provides capacity building and technical assistance for wastewater system design to ensure that projects satisfy all local government and CReW requirements.

Policy and legislative reform efforts are also being pursued, including improving compliance with obligations of the Cartagena Convention and its Protocol on Land-Based Sources of Pollution. Learning, as well as knowledge exchange and dissemination, are also core components of the program, including sharing of pilot-project results and lessons learned through the GEF International Waters Learning Exchange and Resource Network (GEF IW-LEARN) and development of a clearinghouse mechanism to provide information about wastewater management to technical experts, as well as national leaders, policymakers, the private sector, the media, and the general public. While it is too early to assess results, the program has the potential for a catalytic impact in both reducing biodiversity threats and improving the quality and sustainability of WASH services at a regional scale. (For more information, see: www.gefcrew.org.)

U.S. Agency for International Development
1300 Pennsylvania Avenue, NW
Washington, DC 20523
Tel. 202 712 0000
Fax. 202 216 3524
www.usaid.gov/biodiversity