Annex 1. Twelve guiding principles for ecosystem management

The Twelve Principles of the Ecosystem Approach

Principle 1*: The objectives of management of land, water and living resources are a matter of societal choice.*

Principle 2*: Management should be decentralized to the lowest appropriate level.*

Principle 3*: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.*

Principle 4*: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:*
(a) Reduce those market distortions that adversely affect biological diversity;
(b) Align incentives to promote biodiversity conservation and sustainable use;
(c) Internalize costs and benefits in the given ecosystem to the extent feasible.

Principle 5*: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.*

Principle 6*: Ecosystems must be managed within the limits of their functioning.*

Principle 7*: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.*

Principle 8*: Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.*

Principle 9*: Management must recognize that change is inevitable.*

Principle 10*: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.*

Principle 11*: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.*

Principle 12*: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.*

Source: CBD Guidelines – The Ecosystem Approach

It should be stressed that in applying the ecosystem approach, all its principles need to be considered in a holistic way, and appropriate weight given to each, according to local circumstances.

Annex 2. Case Study 1: The Environmental, Social and Economic Impacts of the Akosombo Dam on the River Volta in Ghana

This case study provides an example of how social and environmental issues were inadequately considered during planning for a large dam project. Lack of an ecosystem approach as the project was designed led to major, unforeseen residual impacts including loss of agricultural lands, shellfish industries and biodiversity, soil erosion and infertility, eutrophication and spread of invasive waterplants blocking navigation, increased water-related disease incidence, increased poverty, loss of livelihoods and social disruption, and downstream coastal erosion. Integrated water resource management for the transboundary Volta River Basin is now under development to improve environmental and socio-economic conditions including some remedial measures.

Source: Learning Africa

The **Akosombo Dam** is a hydroelectric dam in southeastern Ghana on the Volta River. The construction of the dam was completed in 1965, creating Lake Volta, one of the world's largest man-made lakes at 8,500 km^2 or 3.6% of Ghana's land area. The flooding of Lake Volta necessitated the relocation of 80,000 people from 700 villages into 52 resettlement villages. The primary purpose of the Akosombo Dam was to provide electricity for the aluminium industry: 80% of its electrical output went to the American-owned Volta Aluminium Company (VALCO), with the remaining 20% to Ghana generally, although the Ghanaian government paid over 50% of dam construction costs.

Generally, the Akosombo Hydroelectric Project (HEP) benefited some economic activities from lake transportation, increased fishing, new farming activities and tourism. The power generated has supplied primary interests within Ghana, as well as going to Togo and Benin. Increasing demand has been addressed by building a smaller dam downstream and retro-fitting turbines at Akosombo, yet current demand exceeds generating capacity. A trend of lower lake levels has impacted operation of the HEP turbines, related to reduced rainfall, catchment runoff and rising temperatures.

Following construction of the Akosombo Dam, there has been a steady decline in agricultural productivity along the lake and its tributaries, where inadequate soils have been exhausted. Agricultural systems are losing soil fertility without the periodic flooding that brought nutrients to the soil before the natural river flow was halted by the dam. Intensified and destructive land uses in the watershed including loss of forest cover and land disturbances on steep slopes have increased the sediment deposition into the reservoir at an alarming rate, which will shorten its useful life. The growth of intensive agriculture has produced a rise in fertilizer run-off into the river. This process, along with run-off from nearby cattle stocks and sewage pollution, has caused nutrient enrichment of the river waters. In turn, the nutrient enrichment, in combination with the low water movement, has allowed for the invasion of aquatic weeds, which block navigation and transportation.

The weeds also provide habitat for black-fly, mosquitoes and snails, which are the vectors of water-borne illnesses such as bilharzia and malaria. Since the installment of the dam, these diseases have increased remarkably. Additionally, the degradation of aquatic habitat has resulted in the decline of shrimp and clam populations, impacting the rural and industrial economies with the decimation of river aquaculture.

Akosombo Dam has cut off the supply of sediment to the Volta Estuary, affecting also neighboring Togo and Benin, whose coasts are now being eaten away at a rate of 10–15 meters per year. A project to strengthen the Togo coast has cost US$3.5 million for each kilometer protected. The changes in the river hydrology have altered the local heat budget which has caused microclimatic changes such as decreasing rain and higher mean monthly temperatures. These larger scale environmental impacts will further compound the problems surrounding the dam’s disruptions to local economic activities and associated, difficult human welfare conditions.

The loss of land experienced by the 80,000 people forcibly relocated meant the loss of their primary economic activities from fishing and agriculture, homes, grave sites, and community stability. Insufficient planning resulted in the relocation of communities into areas that were not capable of providing for their former livelihoods and traditions. Increased economic risks and poverty are associated with those communities most impacted by the Volta River’s development.

Recent initiatives supported by UNEP/GEF, national governments and other partners aim to develop transboundary integrated water resource management for the Volta River Basin and its downstream coastal area, mitigate some of the residual impacts of the dams and increase generating capacity to reduce occurrences of power shortages.

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<u>**Annex 3. Case Study 2: Sustainable Water Management in the Catskill and Delaware Watersheds to Supply Clean Water to New York City, USA**</u>

This case study demonstrates how valuation of watershed services were used in planning investment decisions by New York City, saving billions of dollars on water treatment infrastructure while improving the environmental conditions in the watershed through an urban-rural partnership guided by local leadership.

Source: US EPA 2006

The Catskills and Delaware watersheds (west of Hudson Watershed in the map) provide New York City's 9 million residents with 90% of their drinking water supply. The watersheds have a population of 77,000 and cover 4,000 km^2. Historically, these watersheds have supplied high quality water, but in the 1980s concerns about pollution increased. In 1989, the US Environmental Protection Agency ruled that all surface drinking water supplies had to be filtered unless there were existing treatment processes or natural watershed services that provided safe water. In 1992, the City of New York decided to invest in protecting watersheds rather than new water filtration facilities, which would have cost US$ 6 to 8 billion to build and US$ 300 million annually to operate. Instead of paying to clean up the results of polluting and degrading the pure water produced by the watershed, the city would pay to protect the Catskill environment that was providing it with pristine drinking water.

The costs of investing in watersheds to maintain and restore natural filtration are much lower. Diverse mechanisms for investment in the watersheds are used. Investment of US$1 to 1.5 billion over 10 years was financed by a 9% tax increase on New York City water bills. In comparison, a new filtration plant would have required a two-fold increase in water bills.

Through a process of consultation and negotiation, a watershed agreement was established with local farmers and other interests. The farmers developed a Whole Farm planning program, through which the city would pay both the staff costs of the program and the capital costs for pollution control investments on each farm as an incentive to farmers to join. Farmers administered the program through a Watershed Agricultural Council on which the city and other governmental stakeholders would also sit and vote, but would hold a minority of seats. A particularly important feature of this locally-designed program was that the measures would be selected not only for their pollution control benefits, but they would also be integrated with the farmer's business plan and management practices, providing them with economic benefits and savings.

Funds have been used to finance a US$ 60 million trust fund for environmentally sustainable projects in the Catskill watershed. The city has provided US$ 40 million in compensation to cover the additional costs to dairy farmers and foresters who adopted best management practices. Foresters who adopted improved forest management, such as low impact logging, received additional logging permits for new areas. Forest landowners with 20 ha of land or more who agree to commit to a 10-year forest management plan are entitled to an 80% reduction in local property tax. The city is also purchasing development rights for sensitive land near reservoirs, wetlands and rivers at market price. Farmers and forest landowners are able to enter into 10 to 15-year contracts with U.S. Department of Agriculture to remove environmentally sensitive land from production.

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