**NILE BASIN ECOSYSTEMS, THEIR SERVICES AND CONSERVATION**

**A working paper on instruments and practices for**

**Conservation of ecosystem services**

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**CHAPTER 1: INTRODUCTION**

The Nile Basin is home to a number of critical environmental resources; and with an estimated population of about 230 - 300 million inhabitants, there are challenges in how the resources should be equitably used in the interest of all. But even more importantly, some of the resources are finite in the sense that if squandered they could be used up, but to the peril of the basin’s future inhabitants. A case in point are the basin’s ecosystems and the services they render. Cooperation among the basin countries in the management of such vulnerable resources offers the most viable option, especially in ensuring that resources such as the natural ecosystems are secured, such that even generations to come will be able to enjoy their services. This paper discusses some of the options available for conservation of ecosystem services.

**1.1: NILE RIVER:**

The Nile River is one of the longest rivers in the world, flowing about 6695 km from the source at the head waters of River Kagera, to its delta in Egypt. It flows through 10 countries, in a drainage basin area of about 3.2 Million km² that is characterized by a vast range of ecosystems. In the basin, there are many river tributaries, many lakes and huge tracks of wetlands, mountain forests, lowland tropical forests, woodlands, and even a desert.

Lake Victoria, the largest lake in Africa, is a major ecosystem in the basin. The lake is fed by numerous rivers which flow from surrounding mountain ranges and highlands, the major ones being rivers Nzoia, Sio, Yala, Sondu, Nyando and Migori which flow from highlands in Kenya; rivers Mara, Simiyu and Mbageri which flow in from northern Tanzania; the Kagera River which flows in from Burundi, Rwanda, Tanzania and S.W Uganda, and River Katonga from Uganda.

After flowing in from this vast catchment area, the water then leaves L.Victoria as the White Nile through a single outlet at Owen Falls Dam at Jinja in Uganda. It then flows north through Nothern Uganda, South Sudan, Sudan and on to Egypt. In Uganda, it passes through Lake Kyoga where it is joined by several streams from the Mt Elgon region; then through Lake Albert which also receives waters from River Semliki. Semliki waters originate from a vast area, including the Mufumbiro Mountains located in the confluence area of Rwanda, Democratic Republic of Congo and Uganda, and from the rift valley lakes of Western Uganda, and tributaries originating from the Rwenzori range of mountains.

The White Nile leaves Uganda at Nimule heading north into South Sudan. In South Sudan, it receives more water from the Bahr El Ghazel and Sobat tributaries which originate from D.R. Congo and Central African Republic; then continues to flow north to Khartoum where it meets the other arm of the Nile coming from Ethiopia and referred to as the Blue Nile.

The Blue Nile itself with a catchment of over 5000 km² drains from the western highlands of Ethiopia with the water collecting in Lake Tana. The water then flows out of the lake towards the North West into Sudan where, as indicated earlier, it meets the White Nile at Khartoum. Prior to meeting the White Nile, it is joined by the Atbara tributary which originates from the plateau areas of eastern Ethiopia and Eritrea. About 80% of the Nile’s water is contributed by the Blue Nile.

After combining at Khartoum, the Nile then flows northwards through the desert in northern Sudan and Egypt until it reaches the Nile Delta where it joins the Mediterranean Sea.

The foregoing description highlights the fact that the Nile Basin is a vast area, with many physical features ranging from high mountains and highlands, to plateaus, lowland plains and even desert. Within these varied physical features, there are numerous ecosystems which undoubtedly support a high degree of biological diversity. The following pages discuss more about these ecosystems.

**1.2: THE** **ECOSYSTEMS**

The term “ecosystem” refers to a community of living organisms (plants, animals and microbes) which interact with one another and with the non-living components of their environment (soil, water, air) in an organic system. Ecosystems are controlled by external factors, such as climate, and internal factors such as species composition. In other words, ecosystems are not static; rather they are dynamic entities which may change depending on prevailing circumstances.

Important ecosystems within the Nile basin which exert impact on the health of the Nile River can be broadly described as open waters, wetlands and forests. And as discussed later in this paper, these ecosystems are themselves affected by the nature of land use, which goes to emphasize the fact that natural processes are linked in such a manner that an impact on one process invariably impacts on other processes in a complex web of interactions.

As indicated earlier, L. Victoria is by far the largest lake in the basin, occupying about 69,000 km² and with a drainage area of about 193,000 km². It supports a riparian population of well over 30 Million people, constituting about one-third of the population of Kenya, Tanzania and Uganda. Within the White Nile drainage area, L. Victoria is followed in size by L. Albert (5,660 km²), L. Kyoga (5,600km²) and L. Edward (2,340km²). In addition, there are numerous other smaller lakes which also contribute to the overall welfare of the basin.

As earlier stated, L. Tana is the main water body that feeds the Blue Nile. Its surface area ranges between 3000 km² and 3,500 km², depending on the season, and has a surrounding drainage area of about 11,600 km². Over 3 million people derive their livelihoods from the lake and its immediate surroundings.

The Aswan dam in Egypt is arguably one of the greatest engineering accomplishments of the 20th Century. Lake Nasser which was created by the dam is the second largest man-made lake in the world, covering an area of 3,350 km², considerably larger than, for example, Lake Edward. Also in this category are other smaller but also significant man-made lakes, including Lake Koka in Ethiopia with an area of 250 km², Lake Gebel Aulia in Sudan with an area of 600 km², and Lake Roseires also in Sudan with an area of 290 km².

All the natural open water lakes are surrounded by wetlands, defined by the Ramsar Convention as *“*areas of marsh, fen, peat 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”. There are vast wetlands around Lake Tana and along its tributaries, especially the Atbara tributary. Similarly, there are numerous wetlands associated with the source of the White Nile – around Lakes Victoria, Kyoga, Edward and George, and around Lake Albert. In addition, almost all rivers that discharge into L.Victoria pass through sizeable expanses of wetland deltas before reaching the lake.

Moreover, the Nile River itself also supports a wide range of wetland ecosystems, distributed along the entire length of the basin, including the Nile Delta wetland at the mouth of the river. The largest of these is the Sudd wetland in South Sudan which is one of the largest in the world. Here, the Nile waters spread out into the plains forming the vast wetland known as the Sudd. Past the Sudd, the Nile has only small fringe wetlands along its banks until it forms the Nile delta before entering the Mediterranean Sea.

An important feature that links open water lakes and wetlands is the presence of surface water in both. Because of that common denominator, they tend to have similar attributes and to a large extent support similar flora and fauna. Hence, whilst some authorities consider open water lakes and wetlands to be separate ecosystems, others group them together as “aquatic ecosystems”. Terminologies apart, the important aspect is that they both serve as “stores” of surface fresh water which, as described in Box 1 below is an indispensible resource for human existance.

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| **BOX 1: Importance of Surface Water to the Nile Basin**  Surface water includes the rivers and streams that flow; the lakes, both large and small (including the man-made lakes) and freshwater wetlands.  There are two important issue about fresh water. First, although surface water is seemingly static, the amount in these water bodies is always changing through inflows and outflows. Inflows to water bodies are normally from precipitation (rainfall), overland runoff, ground water seepage, and from tributaries. Outflows on the other hand consist of evaporation, movement into ground water, and withdrawal by animals and humans for their needs. In effect, the amount and location of surface water is always changing over time and space, both naturally and with human help. This cyclic inflow and outflow of water to and from water bodies is referred to as the water cycle. In nature, this water cycle interacts with other natural phenomena and other ecosystems, and that helps to maintain the balance between inflows and outflows.  Second, although it is a renewable resource, freshwater represents only about 3% of all water on earth. Globally open water lakes and swamps account for a mere 0.29%, the rest being held in underground aquifers. The bulk (about 30%) of the world’s surface fresh water is held in Lake Baikal in Asia; another 20% in the Great Lakes of North America, leaving the rest of the world to share only about 0.145% of the available surface fresh water. These statistics serve to illustrate and emphasize the point that a small proportion of surface fresh water is available to the Nile Basin, and therefore that for practical purposes, freshwater should be considered as a finite and limited resource.  Being a finite and limited resource, and yet so essential for human existence, fresh water needs to be carefully managed and not be squandered through inefficient usage or careless handling. Hence, there is need not only for its judicious use, but also for its protection in terms of both its quality and quantity. |

Terrestrially, the plateau areas of the Nile basin comprise of evergreen tropical forests interspersed with savannah woodlands, while the lower reaches are covered in lowland forests that are closely associated with wetlands. The montane forests of Mount Rwenzori and Mount Elgon are home to unique alpine plants of which 75% of the species are endemic, while the Ethiopian highlands are home to remnants of evergreen montane forests also containing a rich mix of species diversity and endemism.

In addition to performing many ecological functions that are part of natural processes, these forests also contain many resources which are essential to the livelihoods of communities living near them. Because the flora and fauna found in the Nile basin ecosystem span several biogeographical biomes, many types of flora and fauna are represented in the basin, which makes it unique in terms of species diversity. This rich mix of species of plants animals in many ways are premiums for ecosystems where they are found and important resources for the basin.

**CHAPTER 2: ECOSYSTEM SERVICES**

Ecosystem functions are defined as “the capacity of natural processes and components of natural or semi-natural systems to provide goods and services that satisfy human needs” (DeGroot 1992). Ecosystem services on the other hand have been defined by the Millennium Ecosystem Assessment (MEA 2005) as “the benefits people obtain from ecosystems”. Of significance is the link between ecosystem functions which must be healthy in order for them to facilitate the provision of ecosystem services. For example, according to the Millennium Assessment Report (MEA 2005), more than three quarters of the world’s freshwater comes from forest catchments; and it is observed that water quantity and quality decline with the decrease in forest cover. In other words, water is a provision which depends on the health of forests. Similarly, natural hazards such as floods, landslides and soil erosion tend to have more severe impacts where forests have been degraded or destroyed, thereby implying the forests’ role in moderating these processes. In other words, proper ecosystem functioning is dependent on its health, and services can best be provided if the ecosystems are healthy or in good condition.

Ecosystem services can be categorized into four types as depicted in Figure 1 below:

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| **Provisioning services**  Products obtained from ecosystems   * Food * Fresh water * Fuel wood * Fibre * Medicines * Genetic resources | **Regulating services**  Benefits from regulation of ecosystem processes   * Climate regulation * Water regulation * Water purification * Pollination | **Cultural services**  Non-material benefits obtained from ecosystems   * Education * Cultural heritage * Recreation/ Tourism * Spiritual & religious |

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| **Supporting services**  Services necessary for the production of all other ecosystem services  • Soil formation • Nutrient recycling • Primary production |

**Fig.1:** *Summary of Ecosystem Services and their relationship to one another*

**2.1: Provisioning services**

These are services related to provisioning, i.e. offering provisions to people. These are manifested in the goods that people obtain from ecosystems, such as food (for example, fish from aquatic systems), timber, fibers, fuel, wildlife and medicines from forests, and water from the rivers, lakes and aquifers. Examples of provisions obtained from ecosystems include:

1. People living around rivers, wetlands and lakes, including man-made lakes derive livelihoods from fishing. Besides fish, aquatic ecosystems also provide communities with other products such as fodder for livestock, fuel wood, medicines, wildlife, etc.
2. Many towns and cities located on or near the banks of lakes and rivers within the basin appropriate their water for domestic and industrial uses from these ecosystems. In Egypt alone, for example, over 700 commercial establishments (hotels and industries) are located on the banks of the Nile and obtain their water provisions from the Nile River. This is in addition to the millions of Egyptians who also depend on the water from the river.
3. Although agricultural production in the Nile basin is generally rain dependent, especially in the upstream riparian countries, Egypt and to some extent Sudan are exceptions in this regard. Egypt has used the Nile waters for irrigation for at least 5000 years and still continues, which is the only way it is able to support one of the highest human population densities in the world. It is followed by Sudan which also undertakes significant levels of irrigation. Egypt and Sudan clearly demonstrate the importance of the Nile for irrigation. In these two countries alone, more than 5.5 million hactares are under irrigation curtsey of the Nile waters.
4. Large dams have been built, not only for provision of irrigation water, but also for generation of hydropower.
5. And finally, water-based ecosystems provide opportunities for transport for both goods and people, and for recreation and tourism. The Nile River has been navigable throughout the history of all riparian countries. Even today, water transport is important especially in Egypt, Sudan and South Sudan which have large municipalities situated on or near river banks, and water transport is an essential component of these countries’ economic activities. In some cases, river streamers provide the most reliable means of transport, especially in South Sudan and parts of southern Sudan where land transport can sometimes be unreliable, especially in rainy seasons.

In other words, livelihoods of many communities within the basin, whether rural or urban depend on provisions from ecosystems.

Box 2 presents two examples of the degree to which specific communities rely on provisioning services by ecosystems where they live.

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| **Box 2A: Lake Victoria as a source of livelihood for communities living around it**  Fishing is a key occupation for communities that live around L.Victoria and its surrounding wetlands. There is both commercial fishing, with large quantities of fish being exploited especially for export, as well as artisanal fishing. For example, in 2004 there was an estimated 57,700 fishing boats on the lake, operated by about 153,000 fishermen, a clear indication of how communities depend on the lake. Even national economies rely heavily on the lake. Besides direct provision of employment, the riparian countries depend on foreign exchange earnings from fish exports. For example since 2008, Kenya has exported fish in excess of 150,000 metric tonnes annually, a clear testament of the importance of L. Victoria’s fishery resource to the country’s economy.  In addition, the industry generates numerous other direct and indirect employments for the people living around the lake – processors, transporters, fish mongers, factory workers and other fishery-related activities. This number is reckoned to be at least 500,000 people (LVEMP, 2006).  Clearly, the importance of fishing and the fishery resources of L. Victoria for communities and the riparian economies cannot be overemphasized.  **B: How Nuer, Dinka and Shilluk communities rely on services from the Sudd wetland**  The value of wetland ecosystem services is well illustrated by the Nuer, Dinka and Shilluk who live close to and depend on the Sudd. As the water of the White Nile and its tributaries pass through the lowland plains of South Sudan, it spreads out to create an area of permanent swamp, the Sudd, covering over 30,000 km² and with the lateral extent of seasonal flooding varying considerably depending on the season. These wetlands are used extensively by resident communities not only as sources of water, but also for grazing livestock especially during dry seasons. These communities have developed a transhumance system to optimize use of the wetlands, whereby large herds of cattle come from far and near during the dry season to graze in the wetland, and then leave when the weather conditions improve. For them, surviving the dry season is dependent almost entirely on provisions of water and fodder by the wetland.  Besides grazing, fishing is the second most important occupation of the Nuer and Shilluk communities, which they do in the wetland. It is estimated that their catch can sometimes be as much as 75,000 tonnes of fish per year (Rabelo and McCartney, 2012).  In addition, wetlands also provide these communities with other provisions, such as fibres for making handicrafts and medicines for treatment of human and animal diseases.  In other words, the whole economy of the region is closely associated with the wetland regime. Whereas the Sudd is a high-profile example of communities’ dependence on wetlands, it is typical in the sense that other communities similarly depend on wetlands that are close to them, especially in the upstrem parts of the basin, although perhaps not to the same extent as the Nuer and Shillik. |

**2.2: Ecological regulatory services**

As intimated earlier, regulating services provided by ecosystems are very diverse and intricately linked to each other in natural processes. They include processes such as primary production in forests, a process by which inorganic elements of water, carbon dioxide and minerals are transformed into organic substances, soil erosion control, and ground water storage and recharge, among others.

Wetlands on their part serve in flood retention, groundwater recharge, water purification, erosion control and maintenance of dry season river flows. In addition, wetlands serve to improve water quality through a process of sedimentation, filtration, chemical and biological immobilization of pollutants and eventual uptake of the residues by plants (Kadlec & Knight, 1996). Box 3 gives an example of where a wetland performs this regulatory function.

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| **Box 3A: The Sudd as an example of ecological regulation by a wetland**  The Sudd of South Sudan very well illustrates the regulatory functions of wetlands. Covering an area of about 30,000 km², the Sudd is the largest flood plain in the Nile Basin and is indeed one of the largest tropical wetlands in the world. Habitats within the flood plain grade from open water and submerged vegetation, to floating fringe vegetation, permanent swamp, seasonal grassland, and finally floodplain woodlands. The wetland is extremely flat, with a slope of 0.01%, which means that water flows through it very slowly indeed.  Seasonal inundation with water drives the hydrological and ecological processes in the Sudd. The lakes, swamps and marshes of the wetland slow down the flow of water, thereby helping it to spread laterally and to cover a wider area. The slow flow also allows the water to stay longer in the flood plain, giving it time to percolate and recharge underground aquifers.  It is estimated that less than half of the water that enters the Sudd is able to exit back into the White Nile, the rest having been lost curtsey of the phenomena of evaporation, evapo-transpiration and ground water recharge. Although a lot of water is lost, these processes are all essential for maintenance of the water balance for the area, thus enabling the flood plain to support the diversity of flora and fauna that it does, and providing livelihoods to millions of people and livestock during dry seasons. |

**2.3: Cultural and aesthetic services**

These are services which are derived by societies through their interaction with nature for educational, cultural or recreational benefits. These may manifest as wildlife which provides a service in terms of outdoor learning or leisure; or a physical features providing opportunities for physical activities, etc. Societies throughout the centuries have always had an urge for exposure to these ecosystem features to derive benefits such as improvement of health and fitness, or enhancement of a sense of spiritual wellbeing, or simply getting aesthetic satisfaction as found in tourism.

In Egypt, for example, the Nile River has a lot to offer in terms of tourism. Tourist attractions range from boat trips on the river, perfectly epitomized by Egypt’s Nile cruises which have developed to such a level that some cruisers are akin to floating hotels - with swimming pools, restaurants, fancy accommodation and night clubs, to water sports like diving, sailing, snorkeling and fishing. Because of these and other attractions (such as the pyramids , great sphinx and lots of historical sites), over 10 million tourists visit Egypt every year, with the sector employing about 12% of the country’s work force.

Whilst Egypt benefits from mass tourism, the industry is not as well developed in upstream countries. As one moves upstream, tourist sites become less varied. In Khartoum, for example, there are sites such as Tuti island which lies at the confluence of the White Nile and Blue Nile, described by some as the jewel of the Nile owing to its unique architecture; there is fishing on the Jebel Al-Awliya dam and bird watching along the river, but the scale of the operation is much less than that seen in Egypt.

Further upstream in the highlands of Ethiopia, there is the Blue Nile waterfall (known locally as the Tis Abay waterfall) where water drops by between 37– 45 metres; and on the White Nile, the Murchison Falls where the water squeezes into a 6 - metre gap before dropping over 100 metres. Also on the White Nile there are activities such as bangee jumping, rafting and kayaking; but for all these, their full tourism potential is yet to be fully developed.

As discussed above, Nile basin ecosystems are home to a variety of flora and fauna (biodiversity). Biodiversity is not only important for maintenance of many complex biological processes which are necessary for sustaining ecosystems services, but is also a key basis for tourism. Biodiversity tourism is found in areas such as Masai Mara Game Reserve in Kenya, Serengeti National Part in Tanzania and Murchison Falls National Park in Uganda, all of which abounds with a wide variety of game animals. This form of tourism is the most lucrative in the upstream countries.

Table 1 provides indications of revenue that the different countries in the Nile basin accrue from tourism income.

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| ***Table 1: On the Value of Tourism in the Nile Basin – Tourism Revenue by country (in Billions of US$):*** *Source – http/en.wikipedia; n.a.= information not available.*  **Country 2010 2011 2012**  Burundi 0.002 0.004 0.003  DR Congo 0.01 0.011 0.06  Egypt 13.6 9.30 10.80  Ethiopia 1.43 2.00 2.01  Kenya 1.60 1.80 2.00  Rwanda 0. 25 0.30 0.34  Tanzania 1,30 1.40 1.60  Sudan 0.09 0.19 0.88  South Sudan n/a n/a n/a  Uganda 0. 80 0. 97 1.10 |

In other words, ecosystems in the Nile Basin need to be conserved not only for their cultural and aesthetic values, but also for their contribution to the economies of riparian states through their support for tourism.

**2.4: Supporting services:**

Supporting services are those that do not benefit mankind directly, but are necessary for the maintenance of all other ecosystem services. They differ from the other types in that their impacts on people are either indirect or occur over a long period of time. Supporting services’ key functions are to maintain ecological components and systems for the benefit of future generations. They represent the future supplies of goods and services that we know of today, as well as those that are yet to be discovered. Examples of these include soil formation, nutrient recycling, and storage of genetic diversity.

However, in some cases this categorization may not be so clear-cut. Some services like soil erosion control can be categorized as either supporting or regulating, depending on the time scale. In the short term, soil erosion can be considered as playing a regulating function since it can have impact on food supplies. In the long term, however, soil movement from one location to another is a physical process of soil formation that will support the functioning of the ecosystem wherever it happens to be.

**CHAPTER 3: THREATS TO SUSTAINABILITY OF ECOSYSTEM SERVICES**

**3.1. Drivers of ecosystem change:** Drivers in this case are external factors and pressures that drive the degradation of the environment generally and ecosystems in particular. Such drivers are many, but they can be grouped into three as follows:

**3.1.1: Population:** Population is an important driver of ecosystem degradation, and the more populations rise, the higher the pressure they will exert on natural resources. The pressure is usually reflected in form of demand for more arable land and intensification of its use, as well as higher demand for other essential resources, such as water, wood fuel and timber.

Typically, all highland areas of the Nile catchment are densely populated. This includes the highland countries of Rwanda and Burundi, the highlands of South-West and Western Uganda, including the slopes of Mt Rwenzori and Mt Elgon ranges, all of which are important catchments for the White Nile. A similar situation obtains in the highlands of Ethiopia which form the catchment for Lake Tana and the Blue Nile.

It is worth noting that countries with some of the highest population growth rates (for example Uganda, Kenya and Tanzania with rates of 3% per annum) are found in the basin. The consequence of high population is, on the one hand, excessive cultivation of farmland which degrades it fast through soil erosion and depletion of nutrients; and on the other hand increased pressure for more land from neighbouring conservation or communal areas, especially forests and grazing land. Because of poor farming methods that do not pay due regard to soil conservation, run-off from farmlands is often high and laden with silt which, if left unchecked leads to low productivity of soils and therefore low crop yields. Moreover, soil erosion impacts go beyond the sites where the erosion has occurred. Surface run-off from degraded soils is normally loaded with sediment which results in sedimentation downstream. Also when run-off bulks as it flows, it can cause physical damage to the landscape.

The impact of population on the ecosystems is exacerbated by poverty which forces people to rely on and often overexploit the natural resources available to them. It is also noted that five of the world’s ten poorest countries are found in the basin. This means that high population growth, coupled with poverty result in increasing pressure on the land and other natural resources, which lead to gradual landscape degradation. Such negative impacts not only perpetrate the poverty, but they also lead to further exploitation of natural resources, hence making ecosystem health even worse. Examples of ecosystem decline as a result of human impact include:

1. The Kagera basin originally had extensive tropical forests where the low populations at the time practiced shifting cultivation, However, in recent decades, demographic pressure have led to extensive decimation of the forests and wetlands as people looked for more arable land and for timber and wood fuel.
2. Deforestation in the Blue Nile drainage area has been so severe that relatively few forest patches remain in western Ethiopia. Forest cover in Ethiopia as a whole is reported to have declined from about 16% in the 1950s to 2% 1990s, principally driven by the need for more arable land by the country’s ever growing population.
3. Finally, degradation of fish diversity in and around Lake Victoria, and in other equatorial lakes of the basin has been on for several decades. The fish community in Lake Victoria has been transformed from its original state of high species richness and high biomass, to fewer species that are dominated mainly by the Nile Perch (*Lates niloticus*). The number of economically important species in the lake has declined over the years from over twenty species to only two or three - mainly Nile perch, Tilapia and Haplochromid species.

As a matter of fact, all equatorial lakes are suffering the same way, a situation that has been brought about by poor regulation by governments and use of uncouth methods of fishing by some fishermen.

Hence, one observes that in the Nile basin generally, agricultural and grazing land are increasingly being degraded, wetlands and forests destroyed, and water quality declining, all because of human activity. Increasing human populations, coupled with poverty which afflicts most inhabitants of the Nile River’s watersheds are key drivers of these negative changes.

**3.1.2: Urbanization:** There are many large and small municipalities situated near or close to the Nile River and its tributaries, and on the shores of its headwater lakes. The most prominent municipalities located along the Nile are Cairo in Egypt with a resident population of about 7.7 million people, Khartoum in Sudan with 5 Million, and Juba in South Sudan with 300,000 people; but there are many other smaller towns and municipalities. For L Victoria the main cities are Kisumu in Kenya, Mwanza in Tanzania and Kampala in Uganda, but here again there are numerous other towns dotted along the shores of Lake Victoria and around all the other inland lakes of the basin. Each of these towns and cities has its own unique attributes; but what they have in common is that they draw water from and discharge all their wastewater effluents into the water body closest to them

It should be noted that globally, wastewater treatment facilities tend to be very expensive to purchase and maintain. For many of these towns and cities in the Nile basin, it is hard for them to afford the high quality standards of effluent treatment that are necessary to keep the environment healthy. Hence, in many cases, the wastewater is discharged back into the water body when it is either untreated or poorly treated. Human wastewater is largely comprised of pathogens, nutrients and suspended solids, while industrial wastes tend to have metals and oils and/or their derivatives. This means that discharging poorly treated municipal effluents into any water body introduces these substances into the water body, leading to its pollution.

The consequence of all these are polluted water bodies which not only has negative impacts on the ecology of the water bodies, for example leading to algal bloom which can cause suffocation of fish, but also makes it very expensive to clean the water for domestic and industrial use since such water is abstracted from the same water bodies.

Box 6 and Table 2 help to illustrate the extent of pollution in L. Victoria.

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| **Box 6: Pollution in and around L. Victoria**  The Lake Victoria ecosystem has undergone substantial, and to some observers alarming changes in the last three to four decades. Masses of algal bloom which is an indicator of pollution have developed; the water’s turbidity increased (water transparency declined from 5 metres in the 1930s to less than 1 metre in the 1990s (Kayombo and Jorgensen, 2006); and although presently under reasonable control, the water hyacinth which was absent in the lake in the 1980s is now abundant, which is also an indication of the level of pollution.  Lake Victoria originally had a multi-species fishery. In the 1950s, for example, the lake had a diverse fish fauna comprising of 28 genera and over 350 species of fish. Within the last 50 years or so, more than 200 of the species have disappeared, partly due to the introduction of the Nile perch which has eaten them to extinction, and partly due to eutriphication which has made the benthic waters uninhabitable for fish. Eutrification is a biological response to excessive nutrients in water which precipitate the growth of micro-plants (phytoplankton). Wherever these plants are, they absorb most of the oxygen for their respiration, thereby denying oxygen to the fish. Fish suffocate if they attempt to live in a plankton infested environment.  A recent study on pollutant loads in the lake indicates that there are altogether 87 large towns in the Lake Victoria basin whose effluents discharge into the lake (Kayombo and Jergensen, 2006). Effluents from these towns include domestic wastewater, industrial discharges and pollutant loads from rivers and streams which flow from urban neighbourhoods. As discussed earlier, urban wastewater contain pathogens, nutrients and suspended solids, whereas pollutants from rivers and streams largely contain sediments and debris which arise as a consequence of soil erosion in agricultural landscapes, and in some cases traces of agro-chemical pollutants, and from urban litter.  Table 2 gives an indication of the pollution load as determined by the study.  It is hard to predict the long term impacts of a polluted L.Victoria. Nevertheless, the impacts are likely to include a serious decline in the biomass of fish, and lake water that is too expensive to purify for domestic and industrial use. These would be impacts that have consequences not only on the health of the water body, but also on the food security of the riparian communities and economies of the countries concerned. Clearly, a polluted lake ought to be avoided. |

**Table 2:** Pollution load in urban and industrial wastewater in Lake Victoria. It is largely due to such pollutants that the observed changes are taking place in the lake.

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| Country | Urban wastewater and run-off loading into L.Victoria, tonnes/year | | |
| Tanzania  Kenya  Uganda  **TOTAL** | BOD | Total N | Total P |
| 5069  10724  2145  **17,938** | 719  2019  767  **3,505** | 292  848  484  **1,624** |

|  |  |  |  |
| --- | --- | --- | --- |
| Country | Industrial waste loading into L.Victoria, tonnes/year | | |
| Tanzania  Kenya  Uganda  **TOTAL** | BOD | Total N | Total P |
| 3,259  860  1,487  **5,606** | 324  57  33  **414** | 208  46  88  **342** |

BOD =Biological Oxygen Demand; N= Nitrogen; P= Phosphorus.

Source: Kayombo and Jergensen (2006).

**3.1.3: Development projects:** All the Nile Basin countries have ambitious plans to build dams on both arms of the Nile River and its tributaries to generate electric power which they badly need for domestic and industrial energy, and to facilitate irrigation to boost agricultural production. Indeed, a number of dams are already under construction both in Ethiopia and Uganda, and many are at various stages of planning. Dams also have other supplementary benefits, such as boosting tourism and fishing.

However, these construction projects are of concern because, as is well known, any alteration in the natural flow of the river will have consequences. For example, a dam may reduce the flow of the water downstream, hence affecting the ecology of the flora and fauna that live there, while upstream the water reservoir created may accelerate the loss of water through evaporation, or increase the incidence of diseases, such as malaria and bilharzias. Dams also block the routes of migratory fish and other aquatic animals. Often the extent of these effects may be more that what was envisaged at the design of the project.

The Aswan High Dam very well illustrates the consequences, both positive and negative, of building dams.

|  |
| --- |
| **Box 5: Aswan Dam – to illustrate the impact of dam construction**  Egypt built the Aswan dam with the dual purpose of generating hydro-power and controlling the water flow of the Nile river. By building the dam, the country would not only generate electricity, but also introduce irrigated agriculture around the dam, and ensure all year round availability of water for that purpose. Indeed, the dam provides about 15% of the country’s energy needs, and it has enabled establishment of irrigated farming in an area that was an empty desert. Curtsey of the dam, over 385,000 hectares are under irrigation, and the fields are able to get the water they need any time of the year. The dam has had other positive impacts. Tourism on Lake Nasser which was created as a consequence of the damming has flourished and fishing on the lake is a successful industry.  But despite these positive impacts, the dam has also had some negative ones. Throughout the millennia, annual floods from the upper Nile, especially the Blue Nile brought down silt which reinforced the fertility of the soils in irrigated fields in the entire Nile valley and the Nile delta. This was nature’s way of keeping the valley and delta fertile and productive.  Building the Aswan dam effectively put an end to this phenomenon, meaning that for Egypt to maintain its production, it has to apply lots of artificial fertilizers, which are not only expensive, but also aggravate the pollution status of the river. Use of these agro-inputs leads to water runoff that is laden with pollutants such as salts, nutrients like phosphorous and nitrogen, and pesticide residues. These represent non-point pollutants that the Nile river and other water bodies in the basin are increasingly suffering from. These pollutants are not good for the water bodies, not only because they change the ecology of the water bodies, thereby affecting the fish and other animal life, but also because they make it very expensive to extract and treat the water for municipal usage.  Moreover, because Lake Nasser was formed in a region that is very hot and dry, it also experiences alarming rates of evaporation. It is estimated that between 10 and 16 billion cubic metres of water is lost every year through evaporation. Since this kind of loss is inevitable and permanent, this means that Egypt could increasingly become water stressed, especially if upstream sources in the catchment are degraded so much that less water flows. Given that fresh water is a finite resource, this is a situation that ought to be avoided. |

**3.1.4: Climate Change**

Based on their observations of global trends, the Intergovernmental Panel on Climate Change (IPCC) confirm that global warming and hence climate change are a reality. However, currently, there is uncertainty about the exact impact of climate change in the Nile Basin. Some results from climate change models show increases in rainfall, while others show decreases. However, the reality is likely to be a combination of both, whereby rainfall amounts increase while dry seasons become longer and more severe. In either case, there will be negative impacts. Increased rainfall may lead to more severe soil erosion and flooding especially in the upper catchment, while extreme droughts will affect food and water, and energy security of all the riparian countries.

Climate change is expected to have other secondary effects for the Nile basin, resulting from the knock-on effect of increases in temperature and rainfall on one hand, and prolonged and more severe droughts on the other hand. For example, it is suggested that rising sea levels together with extreme weather events resulting from global warming will lead to inundation of the Nile delta with sea water, which would lead to loss of important cropland for Egypt, thereby affecting their food security situation. Upstream, increased rainfall might inundate dams and put them under water.

Such secondary effects are likely to affect the way people live and also the management of ecosystems. There is therefore need for research into these areas, the results of which would enable the basin authorities to prepare for the impending changes.

Yet the current threats to ecosystems have the potential of contributing significantly to climate change. For example, wetland ecosystems are known to store large quantities of carbon in two ways:

1) Most wetland plants grow a lot each year and in the process capture (sequester) large amounts of carbon dioxide from the atmosphere, thereby reducing the potential for climate change.

2) Because of flooding, wetland soils are largely anaerobic (without oxygen) which means that the carbon which gets into their soils (through death of plants and animals) decomposes very slowly and so can remain locked there for thousands of years. Destruction of wetlands means not only loss of that particular carbon sink, but also that the carbon that has been locked in that wetland for centuries is released, adding to the total carbon load in the atmosphere and making the climate change situation worse.

Given the extensive wetlands that are found in the Nile basin, there is no doubt that they are important not only as carbon sinks through sequestration, but also as “stores” for carbon that has been sequestered over centuries of years. In other words, wetlands are key to climate stabilization, and it is in the basin’s interest to conserve them.

**CHAPTER 4: CONSERVATION OF ECOSYSTEM SERVICES IN THE NILE BASIN**

Ecosystems have been defined as communities of living organisms which live in a defined area where they interact with one another and with their abiotic environment in a manner that maintains their existence. Hence, an ecosystem approach to conservation is the management of natural resources using system wide concepts and approaches that ensure that all plants and animals in the ecosystem are maintained at viable levels, and that basic ecosystem processes are perpetuated. Thus, an ecosystem approach to conservation involves protecting and restoring the structures, including species composition, and functions of an ecosystem, such that ecosystem services are maintained or restored.

A pressing challenge for the Nile basin concerns the means by which valuable ecosystems can co-exist alongside expanding human populations and growing economies within the basin. For co-existence to continue, riparian countries must work together in managing their land and water resources, not only for the welfare of the people, but also for the welfare of ecosystems as a way of securing their services.

A number of approaches are in use to conserve ecosystems in the Nile basin countries. These include use of legal instruments by governments, invocation of international conservation instruments, and watershed management approaches outside of protected areas.

**4.1: Use of legal instruments in ecosystems conservation:** This includes all ecosystems that are managed under some legal regime, whether initiated nationally or internationally. These include:

**4.1.1: National legislation creating National Parks, Game Reserves and Forest Reserves:** For most riparian countries, policies and regulationsfor protection of conservation areas date back to the early 20th century when the colonial governors used decrees to reserve tracks of land for conservation either as forest water towers or as biodiversity hotspots. Except for a few modifications here and there in the laws and regulations, the conservation objectives have remained more or less the same, as have the areas under protection.

Despite a number of challenges which vary from country to country, this approach remains one of the most viable means of conserving ecosystems and their services. There are challenges of persistent attempts to encroach on the conservation areas, poaching of animals and demand for benefit sharing by neighboring communities. Nevertheless, most of these areas are holding well and delivering valuable ecosystem services. Table shows some of the key conservation areas that are secured under this arrangement.

***Table 3: Some of the key conservation areas in the Nile Basin****.*

|  |  |
| --- | --- |
| **Name of Protected Area** | **Countries where it is located** |
| Dinder NP  Garabella NP  Garamba NP  Omo NP  Mt Elgon NP  Queen Elizabeth NP  Murchison Falls NP  Ruvubu NP  Virunga/Mgahinga/Volcano NP  Kagera NP  Rumanyika GR  Ibana GR  Minziro/Sango Bay FR  Masai Mara NR/Serengeti NP  Lake Tana  Semien Mountain NP | Sudan/Ethiopia  Sudan  DR Congo  South Sudan/Kenya  Kenya/Uganda  Uganda  Uganda  Burundi  DR Congo/Uganda/Rwanda  Rwanda  Tanzania  Rwanda  Tanzania/Uganda  Kenya/Tanzania  Ethiopia  Ethiopia/Eritrea |

**Key: NP = National Park; GR = Game Reserve; FR Forest Reserve:**

*Source: State of the river Nile basin – Environmental resources, by NBI.*

This approach has so far been effective, despite the challenges of poaching of animals and in a few cases encroachment by neighbouring communities in search of land for agriculture.

The main limitation of this approach is that National Parks and game Reserves cover only a small proportion of the land area, which means that some critical ecosystems are not conserved through this approach.

**4.1.2: Use of international instrument - RAMSAR Convention:**

The RAMSAR Convention is an international instrument for conservation of wetlands of international importance. Initially it focused on wetlands that were considered important bird habitats, but its observance now includes wetlands of economic and ecological importance.

Initially in the last century, there was no policy on conservation of wetlands, and consequently over the years many of them were drained for cultivation, especially in the densely populated areas of the Kagera basin (including Burundi, Rwanda, and S.W. Uganda). However, the need for conservation of wetlands is now recognized, and there are measures in the basin to conserve wetlands using the Ramsar convention as the tool. Within the basin, many sites have been nominated by the individual countries and accepted as Ramsar wetland sites of international importance, a move that has helped to close a void that existed for a long time.

Table 3 gives examples of some of the sites, the country where they are found, and their approximate area and dominant type of ecosystem.

Although the area so far covered is small (probably only about 20%) compared with all the basin wetlands that need some sort of protection, the approach demonstrates that the Ramsar convention is well respected and that invoking it is an effective way of wetland conservation.

Potentially, therefore, this is a tool that could be more widely used to conserve large tracks of wetlands as most countries in the basin are parties to the convention. Basin countries that are not signatories to the convention (and therefore cannot use this tool) are Ethiopia and Eritrea. For the sake of conservation of wetland ecosystem services, these countries should be encouraged to become parties to the convention so that they too are able to use the tool, and all countries should endeavour to make use of the tool to conserve more wetlands.

**4.2: Watershed management approaches:** Watershed management can be broadly described as an undertaking to maintain the equilibrium between elements of the natural ecosystem – vegetation, soil and water, and the wild life living therein. It is also the process of organizing land use and use of other resources in a watershed such that it continues to provide ecosystem goods and services. Hence, watershed management includes the rehabilitation of degraded watersheds by engaging in activities that restore the productivity of the land, such (a) soil erosion control – building of terraces, gully plugs, grass barriers and check dams, and (b) tree planting to restore the attributes of tree cover. Hence, in watershed management efforts are made to maintain or improve the health of existing ecosystems, while at the same time attempts are made to rehabilitate degraded elements of the environment.

Experience from elsewhere in the world indicates that watershed rehabilitation is a time-consuming and very expensive undertaking. Outcomes of rehabilitation tend to take long to be realized, and for many reasons, success is not always guaranteed. In other words, once lost, provision of ecosystem services cannot be easily recreated. Hence, it is more prudent to avoid degradation of watersheds than counting on their rehabilitation after the damage is done. This is particularly true for the Nile basin countries which are poor and developing and can hardly afford the costs of rehabilitation.

**Table 3**: *RAMSAR wetland sites of international importance found in the Nile basin.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Country** | **Site** | **Wetland area (ha)** | **Dominant type** |
| DRC | Virunga NP | 800,000 | Freshwater lake and marshes |
| Kenya | Yala swamp | 200,000 | Freshwater and marshes |
| Uganda | L. George wetland system  L. Nabugabo wetland system  Lake Bisina wetland system  L.Mburo-Nakivale system  L. Nakuwa wetland system  L.Opeta wetland system  Lutembe Bay  Mabamba Bay  Nabajjuzi wetland system  Murchison Falls-Albert delta  Sango Bay wetland system | 15,000  3600  54,229  26,830  91,150  68,900  98  2400  1750  17,293  55,100 | Freshwater lake and marshes  Freshwater lake and marshes  Freshwater lake and marshes  Freshwater lake and marshes  Freshwater and marshes  Freshwater and marshes  Freshwater and marshes  Freshwater and marshes  Freshwater and marshes  Freshwater and marshes  Seasonal lakes and marshes | |
| Sudan | Dinder National Park | 1,084,600 | Seasonal lakes and marshes |
| South Sudan | Sudd wetland system | 5,700,000 | Permanent/seasonal rivers |

**(**Source: RAMSAR website; *State of the river Nile basin – Environmental resources, by NBI*)

**4.2.1: Current watershed management initiatives in the Nile Basin**

Because of the connection between the ecosystem health and human well being, it is essential that mechanisms are found that satisfy the demand for human well being, while at the same time maintaining the health of ecosystems. To that end, institutions charged with stewardship of key components of ecosystems in the Nile basin strive to develop mechanisms that should in the long run enable the different ecosystems to remain healthy, while at the same time the livelihoods of people are improved. Such institutions include the following:

**4.2.1.1: Nile Basin Initiative (NBI):** Being an intergovernmental organization that is dedicated to the sustainable management of the waters of the Nile, NBI has interest in the welfare of both the people and the ecosystems that sustain the river. To that end, it has developed a Nile Basin Strategic Action Programme (SAP) (2011) in which there is a shared vision for socio-economic development based on the basin’s water resources. The SAP recognizes the river as a resource with vast potential to serve as an engine for socio-economic development, and therefore identified four strategic directions or areas of emphasis around which the water resources will be developed. These are:

1. Water-related socio-economic development
2. Water resources planning and management
3. Environmental and water-related natural resources management
4. Climate change adaptation and mitigation.

Strategies for developing these areas have been developed and some are under implementation.

Secondly, the NBI has developed an Environmental and Social Policy and Social Management framework (2013) in which it commits to focus on specific issues, including human health, water quality, biodiversity conservation and wetland management, among others. This commitment also implicitly highlights the need for ecosystem conservation as a means to sustainably benefit from ecosystem services.

In other words, the framework for conservation of ecosystem services already exists within the NBI, and all that is needed are implementation strategies and plans for specific ecosystems.

On the ground, the NBI has put in place a two-pronged approach to implementation of the strategic areas. First, it has established the Eastern Nile Technical Regional Office (ENTRO) based in Addis Ababa whose role is to coordinate the implementation of projects in Ethiopia, Egypt and Sudan. ENTRO’s project portfolio is varied ([www.nilebasin.org](http://www.nilebasin.org)), but a few stand out as addressing issues of watershed management. They include:

1. **The Eastern Nile Watershed Management Project (ENWMP):** The Eastern Nile watershed covers an area of about 1.7 Million Km² that supports about 110 million people located in Ethiopia, Sudan and Upper Egypt. Because of intensive use the watershed is severely degraded, the evidence of which is severe soil erosion, high sediment load in water bodies and overexploitation of most natural resources. The ENWMP aims to develop an integrated watershed management approach that will address and reverse the root causes of the degradation, leading to improved livelihoods for the people and a better environment.

The project has so far achieved the following:

* Agreement on the process and tool to analyze and characterize sub-watersheds
* Identified the institutional requirements for a basin-wide programme
* Identified critical hotspots for urgent attention
* Identified a number of investment projects

1. **The Baro-Akobo-Sobat (BAS) water resources development project:** Which aims to enhance planning and management for water resources in the BAS sub-basin, and to counter threats to the watershed. The project is in advanced stages of appraisal and is expected to commence soon.
2. **The Flood Preparedness and Early Warning (FPEW) project:**This project aims to enhance collaboration among universities and other researchers in the Eastern Nile countries of Ethiopia, Egypt and Sudan in addressing key water resources development and management issues across national borders. The project aims at enhancing synergy among the researchers in modeling for different scenarios and in developing tools and information management systems for evaluating large-scale investment options. Some of the project’s achievements include:

* Putting in place a Geographical Information System (GIS) and spatial analysis services
* Developed a remote sensing analytical tool
* Developed a database management system that is equipped with a user interface.

Secondly, the NBI has also established the Nile Equatorial Lakes Subsidiary Programme (NELSAP) which is based in Kigali, Rwanda, and oversees programmes and projects in Burundi, DR Congo, Rwanda, Kenya, Tanzania, South Sudan and Uganda, and to a lesser extent Egypt and Sudan. NELSAP also emphasizes trans-boundary cooperation and building of capacity for project implementation. NELSAP also implements a variety of projects, including watershed management projects; but the ones that stand out include the following:

1. **Sio-Malaba-Malakisi (SMM) project:** The SMM rivers originate from the forests of Mt Elgon, The Sio river discharges in Lake Victoria, whereas the Lwakhakha and Malakisi rivers combine to form the Malaba river which discharges in L. Kyoga. The basins of all these rivers are shared by Kenya and Uganda. The SMM basins are home to over one million people, most of whom depend on agriculture as their main source of livelihood. Consequently, the basins face serious environmental and water resources problems – shortage of arable land, loss of vegetation cover, soil erosion, increased surface run-off, loss of soil fertility, water pollution, water-related conflicts, etc. These problems make SMM basins a good candidate for watershed management activities.
2. **Mara River Basin management project:** Shared by Kenya and Tanzania, the Mara river originates from the forests of the Mau Escarpment in Kenya; meanders through agricultural farms; then flow through the Masai-Mara Game Reserve and Serengeti National Park in Tanzania, and through more farmlands in Tanzania before emptying in L. Victoria. Altogether, the basin is home to over one million people who are mostly engaged in agricultural activities and are mostly poor. The Mara River basin also faces serious environmental and water resources problems – loss of vegetation cover, soil erosion, increased surface run-off, loss of soil fertility, water pollution, etc.

In both cases, NELSAP has initiated watershed management projects and engaged WREM International ([www.wremintl.com](http://www.wremintl.com)) for their implementation with the following objectives:

1. To review and analyze policy and legal frameworks in Kenya, Uganda and Tanzania, and recommend amendments for harmonized frameworks to facilitate joint planning and management of the SMM and Mara basin water and other resources.
2. To assess the investment potential, and develop an investment strategy and action plan for harnessing the basins’ resources.

A number of activities aimed at achieving the objectives are under way.

1. **Kagera Basin Project:** A project sponsored by NELSAP with funding from GEF and implemented by FAO ([www.fao.org](http://www.fao.org)) is attempting to rehabilitate the Kagera basin through the watershed management approach. A host of activities are being undertaken, but the key ones include:
2. Enhancement of regional collaboration in generation and sharing of information
3. Development of enabling policies both at national and local government level, to address some of the ills
4. Engaging stakeholders in the basin to teach them appropriate ways of farming
5. Introducing better and more sustainable land-use systems and resource management practices.

The project started in 2009 with a budget of US$ 6.4, and is due to end at the end of 2014. However, whereas the project may have achieved some of the milestones it set out to achieve, for example it has planted more than 1.6 million trees, it is not apparent that the desired outcome of a rehabilitated watershed will be realized. Working across four countries with multiple stakeholders in each, the project demonstrates clearly how complex and expensive watershed management approaches can be.

A clear message from this project is that existing ecosystems ought to be conserved in their present state, because rehabilitation is not quite a viable option.

However, watershed management projects tend to be quite expensive, with outcomes taking long to be realized. The high cost means that interventions can only be done in a limited number of watersheds; and the long timescale means that this approach alone cannot be relied upon to conserve ecosystems that are critically in danger. In other words, the approach works best in combination with one or more other approaches.

**4.2.1.2: East African Community:** The East African Community (EAC) is another regional institution within the Nile basin that has stewardship responsibilities for ecosystem management.

The treaty of establishment of the EAC provides for joint management and utilization of natural resources within the community for the benefit of all partner states; and also provides for joint development and adoption of harmonized policies and strategies for sustainable management of trans-boundary natural resources within the community. To reinforce the provisions of the treaty, member states have also agreed to and ratified a protocol on environment and natural resources management which spells out modalities for achieving the desired cooperation. The protocol makes it clear that member states should harmonize policies, laws and programmes relating to the management and sustainable use of natural resources, and in case of water that member states should utilize water resources, including shared water resources, in an equitable and rational manner.

The EAC has established the **Lake Victoria Basin Commission** as the specialized institution responsible for stewardship of the Lake Victoria basin and ensuring sustainable development and management of natural resources within the basin. This mandate covers a substantial catchment for the White Nile.

The Commission has developed a strategy that is aimed at maintaining the health of ecosystems within the Lake basin ([www.lvbcom.org](http://www.lvbcom.org)). The strategy includes the following key actions:

1. Changing economic decision models to include and ensure that all ecosystem services are valued. In other words, to move away from a situation where only services that are bought and sold in the market are valued.
2. Improving policy processes by integrating and harmonizing decision making across sectors, to ensure that policies are focused on protection of ecosystems.
3. Influencing the behavior of individuals by undertaking public education on why and how consumption of threatened services should be reduced.
4. Developing and using environment-friendly technologies that are aimed at increasing production with minimal harm to the environment.

In terms of accomplishments, the Commission has achieved the following milestones in terms of water quality management:

1. A water release and abstraction policy has been finalized and adopted by partner states.
2. Harmonized regional standards for discharge of industrial and municipal effluents into water bodies within the L. Victoria basin agreed.
3. A regional strategy for management of the water hyacinth developed
4. Feasibility studies and designs for construction or rehabilitation of selected wastewater treatment facilities within the basin completed.
5. Watershed rehabilitation activities undertaken for the Mt Elgon watershed both in Kenya and Uganda has been in progress for a while.

Hence, although on ground implementation of some of these initiatives are yet to occur, these are moves in the right direction, and one would hope that implementation will commence soonest.

**4.2.1.3: Inter-Governmental Authority on Development:** The Inter-Governmental Authority on Development (IGAD) is a sub-regional organization originally established to coordinate development initiatives in the dry and drought prone environments of the Horn of Africa. Its members states include: Djibouti, Ethiopia, Eritrea, Kenya, Somalia, South Sudan, Sudan and Uganda; and its headquarters are in Djibouti.

IGAD currently has a water resources management programme through which it aims to institutionalize cooperation among its member states in the development of policies and legal frameworks for effective and sustainable water resources management. The programme aims to strengthen national and regional capacities in water management, and to establish a regional dialogue in water resources management.

Given that the majority of IGAD member states fall within the Nile Basin, it is expected that the benefits derived from its support will enhance national capacities for management of their water resources for the benefit of the Nile Basin.

**4.2.1.4: National Governments:** The other key players in ecosystem managementare of course the national governments. They put in place policies and legal frameworks for management of natural resources under their jurisdiction.

Results of a survey to assess the status of water-related policies and legislation at national level are presented in Table 3. The survey shows that most countries in the basin do have the requisite policy and legal frameworks for management of water. However, only a few of them (e.g. the one of Rwanda) seem to be adequately comprehensive to cover all issues concerned with management of ecosystems as sources of water. Moreover, their interventions tend to be limited to national borders, therefore missing the fact that actions taken at one level within the basin have downstream implications.

What this means is that overall within the basin, there is need for national governments to revisit their policy and legal frameworks for water governance so as to ensure that aspects relating to conservation of ecosystems, water quality and trans-boundary issues are better articulated. In other words, there is need for national policies that reflect concern for trans-boundary aspects that reflect the fact that all riparian countries are part of a larger and complicated system within which interests of all stakeholders should be taken into consideration.

**Table 3:** *Showing status of policy and legal framework for water management at national level*

|  |  |
| --- | --- |
| Burundi | Has a decree on water resources management of 1992 which addresses water issues in a limited way. For example, the decree does not seem to adequately address issues of water governance. |
| DR Congo | No clear policy and legal framework, but constitution refers to need for judicious water management. There is need for a specific law and legal framework. |
| Egypt | Has a water law of 1982 and a new water policy titled “Water Policy toward 2017”. However, the policy decentralizes water management even though there is no capacity at local level. |
| Ethiopia | Has a water resources management policy 1999 and a water sector strategy which translates the policy into action. |
| Kenya | Has a water management Act of 2002, and a trans-boundary water policy; but these are yet to be aligned to the new Constitution. |
| Rwanda | Has legislation relevant to water governance. The new “Organic Law of 2005” provides for the precautionary principle, the polluter-pay principle and for community participation. It is probably the most up-to-date policy in the Nile basin. |
| Sudan | Has a Water resources policy and legal framework of 2000 |
| South Sudan | Information not available |
| Tanzania | Has a water resources management policy of 2002 and a comprehensive framework for water management. |
| Uganda | Has a national water policy of 1999 which provides for coordination and sustainable management of water resources, including a wetlands management policy and institutional framework. |

**4.2.4: Conservation Initiatives based on International Carbon Markets**

Recent attempts to mitigate global warming have popularized the biological form of carbon storage. It is now acknowledged that forest and wetland ecosystems have capacity to absorb (or sequester) considerable amounts of carbon dioxide from the atmosphere, thereby reducing the amount of free carbon in the atmosphere which is responsible for the global warming phenomenon. Having a value for this process is seen as presenting opportunities for conservation of ecosystems and improvement of watersheds.

Under the CDM, industrialized countries can invest in carbon sequestering activities in developing countries in return for carbon offsets which then count for emission reduction targets specified in the Kyoto Protocol. Hence, under the protocol, investments in form of carbon sequestration projects can represent valuable financial inflows for developing countries while at the same time helping the countries to maintain their forest ecosystems and the services they provide.

This mechanism is open to both privately and public owned ecosystems. Experience suggests that if undertaken with private land owners, carbon sequestration projects can offer reasonable income to individual farmers and/or communities, thereby enabling them to conserve their forests and sustain the services the latter provide.

In order to save some of the critical forests, there is need for authorities in the Nile basin to embrace such schemes that would provide incentives for private land owners and communities to conserve their forests. “If it pays, it stays” is a catch-phrase that has been used to summarize the importance of generating incentives for local communities, private sector and individuals to invest in ecosystem conservation.

|  |
| --- |
| **Box 10: Overview of Carbon Markets**  Carbon markets have developed a language of their own which for most readers requires some explanation, as follows:  **Carbon Offsets:** *A carbon offset is a unit of measure which is sufficient to neutralize a ton of Carbon Dioxide (CO2) emitted in the atmosphere*. Carbon offsets can be earned ***eithe***r by avoiding the release of the same amount of CO2 into the atmosphere, ***o***r by absorbing the same quantity of CO2 from the atmosphere. Release of CO2 can be avoided by, for example, employing a more efficient industrial process with the net effect of reduced emissions; on the other hand, CO2 can be absorbed from the atmosphere (sequestered) by planting trees which use it for photosynthesis. For example, if a manufacturing company which was previously emitting 10,000 tons of CO2 per year employs a more efficient process and the emissions are reduced to 1000 tons of CO2 per year, it will have earned ***credits*** worth 9000 tons of CO2 per year. Alternatively, the same company could earn the same number of credits if it planted (or saved from destruction) a tree area sufficient to absorb 9000 tons of CO2 per year.  Simply put, therefore, carbon markets essentially consist of two types of interactions:   1. The interaction whereby a company or country is seeking to offset its emissions. Companies in industrialized countries do this either by employing more efficient technologies or by facilitating the planting of trees (or reduction in deforestation) in tropical regions where carbon sequestration is efficient. As indicated earlier, both processes lead to reduction of CO2 in the atmosphere and therefore have the potential of earning co-called carbon credits.   Involvement in this market by developing countries is currently limited to the carbon sequestration aspect, whereby they provide land for tree planting or provide forests for conservation.   1. The interaction whereby companies with accumulated credits “sell” those credits to other companies that need to offset their emissions.   Currently, there are two types of markets, one regulated and the other voluntary.  **Regulated markets:** These are markets that areregulated by international instruments, especially the Clean Development Mechanism (CDM) of the Kyoto Protocol, and also by other instruments such as the European Union Emissions Trading Scheme (EU ETS) which regulates the markets in Europe.  **Voluntary market:**  Consist mainly of national schemes such as the United Kingdom’s Emissions Trading Scheme (UK ETS) or the Chicago Climate Exchange Scheme of the US which regulate activities of companies under their jurisdiction.  **Drivers of these markets:** The main driver for these markets is the international policy frameworks, such as the CBD, Kyoto protocol, UN Convention on Climate Change, etc. These policy frameworks have been agreed mainly as a response to public awareness of and concern over the prospect of climate change and its likely global impact. But there is also a positively increasing social responsibility on the part of the private sector which is also helping to drive the market.  The Ecosystem Marketplace estimates that over the last decade or so, more than 800,000 hectares of forest and agricultural land have been committed to carbon sequestration thereby yielding carbon offsets (or credits) worth over US$ 92 Million. Many of these offsets are being traded in voluntary emission reduction markets, while others are financed through the Clean Development Mechanism (CDM) protocol that has been agreed by the International Community.  *Source: Exploring the markets for Carbon offsets, by Taiyab, N (2006), IIED, London.* |

There are many opportunities for CDM projects within the Nile Basin. As discussed before, the basin has many critical ecosystems, including forests and wetlands and only a small proportion of them is under some form of protection. Moreover, those under protection mostly tend to be ones under the stewardship of public institutions. Large areas of forests and wetlands that are owned either by private individuals or by communities remain vulnerable. Engaging these owners and providing them with incentives seems to be the only viable approach to conservation of such forests and wetlands. Incentives through the Clean Development Mechanism (CDM) are a workable option.

Carbon sequestration projects are already known in Africa, or for that matter East Africa. Jindal, et al (2008) have identified over 20 such projects in Africa, including a few in the Nile Basin countries of Kenya, Ethiopia and Uganda. Whilst some of these are securing the conservation of publicly managed ecosystems, a good number are addressing community forests, thereby highlighting the potential of this approach. Table 4 summarizes the key information on each of these projects.

**Table 4: *CDM Projects in Eastern Africa***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Project Title** | **Host community** | **Investors & $ Amounts** | **Year began** | **Implementing Agency** | **Carbon offsets** | **Benefit** | **Other details** |
| The international small group and tree planting program | Tanzania  Kenya  Uganda | Dow chemical Co  WB & Bio-carbons  US $1.245 million | Since 1999 | CAAC | 4.47 MtCO2 by 2030 | Carbon rights to CAAC, NTFP to community | Over 400 farmer groups over 5 million seedlings planted. |
| Community rangeland rehabilitation for Carbon sequestration | Sudan | GEF $1.5 million | 1995-2000 | GoS (Environ) | 0.18 MtCO2 | To local community including NTFP’s | Trees planted as wind breaks over several kilometres. 700ha of rangeland rehabilitated |
| Forest rehabilitation in Mt Elgon and Kibale National Parks | Uganda | FACE foundation $ not available | 1997-2003 | GoU (UWA) | 7.1 MtCO2 over 99 yrs | Carbon offsets with FACE. All other rights with UWA | Project has FSC certification |
| Plan VIVO project | Uganda | UK-DFID USAID Tetra Park. £1 million | 2003-12 | Ecotrust - Uganda | 0.9 MtCO2 | Tetra Park with Carbon offsets; 60 % of sales to farmers | Carbon sequestration through small scale tree planting on 5000 ha |
| Western Kenya Integrated Ecosystem Management Project | Kenya | GEF & Japan PHRD $ 6.8 Million | 2005- | GoK (KARI & KEFRI) | Not available | Local community rights to NTFP’s; Carbon rights not yet determined | Project will promote conservation activities to control sediment and nutrient flow into lake Victoria. |
| Commercial Plantation Project | Tanzania  Uganda | Tree Farms of Norway $0.6 million | 1997 | Busoga Forestry Co. | 2.3 MtCO2 | All rights with the BF Co | SGS certification |
| Participatory Environment Programme (PEMA) | Tanzania | Multiple Donors  $ not available | 2008 | CARE & ICRAF | 0.05 MtCO2 | NTFP’s to local communities; cash benefits shared with farmers | 19 villages/communities involved |
| Nile Basin Restoration | Uganda | World Bank Bio-Carbon  $ not available | 2006 | GoU- NFA | 0.29 MtCO2 by 2017 | Carbon credits with WB; Timber benefits with farmers. | Planting pine mixed with native trees. 2000 ha planted. |
| Green Belt Movement (GBM) | Kenya | GBM, WB, Bio-Carbon $ not available | 2006 | GBM | 0.38 MtCO2 by 2017 | Carbon rights to farmers who receive payment | Project reforested about 2000ha of degraded land |
| Humbo assisted regeneration | Ethiopia | World Vision, WB, Australia and Bio Carbon  $ not available | 2006 | World Vision | 0.16 MtCO2 by 2017 | Biomass benefits to farmers; Carbon credits benefit with implementing agency. | Project restored about 2500 ha of degraded land around Himbo town in S. Ethiopia |
| The Namwaba Forestation project | Uganda | European Banks (EBRD, EIB & EMI)  $ 12.85 million | 2007 | New Forest Co. Ltd | 0.26 MtCO2 over 20 years | Carbon offsets belong to investors | Project planting eucalyptus and pine forests. Project in CDM pipeline. |

*Source: Jindal, R. et al (2008)*

However, currently only land-use change in form of afforestation and forestry conservation activities are eligible for benefits under the CDM. This is a major limitation as it excludes some of the critical ecosystems in the Nile Basin that need to be conserved. For example, conservation and rehabilitation of wetlands are excluded from the mechanism; yet, as Box 11 shows, there is a strong case for inclusion of wetlands because of their immense capacity both to sequester carbon and also to store it.

However, there are moves to include them wetlands under the CDM (Wetlands International, 2013). Whenever that happens, trading in carbon markets will present immense opportunities for the wetlands of the Nile basin not only because of their expanse, but also because of the strong case for conserving them to mitigate the impact of climate change.

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| **Box 11: Wetland Conservation and CDM**  It is a well known fact that wetlands contribute quite significantly in carbon sequestration and as carbon sinks. Globally, the peat found under most wetlands is known to hold 30% of the soil carbon (estimated at 550 GT of carbon), which means that as the wetlands are drained, this carbon is released into the atmosphere, adding to the problem of global warming. In other words, wetlands need to be conserved in order to ensure that the peat underneath them is not exposed to release the carbon it holds.  Secondly, it is also well known that wetland plants tend to be more fast growing and therefore more able to absorb (sequester) more carbon from the atmosphere. Hence, wetlands are also important for reducing atmospheric carbon, which reduces the potential for climate change.  It is for this reason that Wetlands International proposed to SBSTA (Subsidiary Body for Scientific and Technical Advice) the inclusion of wetlands in the CDM mechanism. Specific activities in the proposal which would benefit from the CDM are:   1. Avoided drainage of wetlands 2. Re-wetting and rehabilitation of already drained wetlands 3. Where drainage is inevitable, reducing drainage depth to avoid exposing peat 4. Peat fire prevention   Given that the Nile basin has large expanses of wetlands, the countries of the basin would be well advised to support the proposal by Wetlands International, because once approved, there would be resources from the International Community to help curb the destruction of wetlands, and therefore to ensure the sustainability of ecosystem services from them.  *Source: Wetlands International, 2013.* |

**CHAPTER 5: OTHER AVAILABLE OPTIONS FOR CONSERVATION OF ECOSYSTEM SERVICES**

Although governments in the Nile basin are expending considerable efforts and resources to conserve ecosystems, there is no doubt that a lot more needs to be done. The shortcomings of each of the approaches being used have earlier been highlighted, indicating that using current approaches alone cannot ensure the conservation of all critical ecosystems. In fact ecosystem degradation has continued over the years in spite of these efforts. There is need, therefore, for Nile Basin countries to adopt new and innovative approaches to conservation as additional measures to reinforce the instruments currently in use.

Pressures on ecosystems are exerted by both rural as well as urban societies. Yet, the common tendency is for urban communities to expect their rural folk to sorely meet the cost of conservation either by undertaking conservation activities on their land or by foregoing resources found in a particular ecosystem. However, since ecosystem services are enjoyed by even the urban dwellers, in the interest of fairness and equity, there is no doubt that urban communities should also be involved. Owing to the nature of their needs and activities, urban communities are usually involved either as beneficiaries of ecosystem services – water, recreation; or as polluters by discharging domestic and/or industrial waste into the environment. Both these activities call on urban communities to contribute to activities that ensure ecosystem health.

**5.1: Incentives for Ecosystem Conservation**

As discussed earlier, there are significant pressures exerted on the ecosystems from both the urban and rural environments. Nowadays it is possible to address these pressures and their drivers through a mixture of approaches. Two approaches to involve urban communities have so far been implemented elsewhere in the world, namely, application of the Polluter Pays Principal, and imposition of Ecosystem Levies. The elements embodied in these approaches are:

1. Regulation – Polluter Pays Principal
2. Incentive schemes – Payment for Ecosystem Services

These approaches are based on the thesis that if people understand that their quality of life is dependent upon the health of their natural environment, and that they have a direct stake as beneficiaries of ecosystem services, they will willingly contribute to the conservation and sustainable use (or cleaning up) of the ecosystems in question.

The incentives discussed below are intended to illustrate how that level of participation especially by urban dwellers could be achieved in the Nile basin.

**5.1.1: Application of the Polluter Pays Principal**

The Polluter Pays Principal (PPP) states that whoever is responsible for damage to the environment should bear the cost of its restoration. This is generally accepted not only because it appeals to the sense of justice, but also because it is thought to enhance efficiency for those with potential to pollute. Polluters in this sense are those whose activities damage the environment and impose costs in its rehabilitation. The principle is borne out of the *Rio Declaration on the Environment and Development* which calls on national authorities to endeavour to promote the internalization of environmental costs through “use of economic instruments”. Applied appropriately, policies and regulations based on the PPP should enable a country or community to protect the environment by minimizing polluting activities, and where damage occurs, to have the resources for rehabilitation.

However, for PPP to be applied, the type of pollution, as well as the polluter must be clearly identified and the degree of damage assessed and costed, such that the payment by the polluter is equivalent to the damage caused. The difficulty of measuring these two parameters is generally still a challenge limiting wide application of the PPP, although the OECD countries have overcome the challenges and are able to apply the principle with little difficulty. Box 8 illustrates this development in OECD countries.

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| **Box 8: Wastewater user charges in OECD countries**  Many OECD countries levy water emission fees to households and industries for discharge of wastewater into municipal sewers in case of households and for collection and treatment of the polluted water in case of industries.  Domestic wastewater normally contains pathogens, detergents and suspended matter, all of which ought to be cleaned out before the wastewater is discharged into any natural water body. Domestic users contribute to this cleaning by paying a levy to their service providers that is proportional to to the quantity of wastewater they produce. The revenue so generated from the levy is used to clean the wastewater and ensure that it is relatively clean before it is discharged into any water body.  Industrial wastewater on the other hand may contain one or more of a host of chemical pollutants, e.g. lubricants, metal salts, paint, pesticides, fertilizers, etc. Normally in OECD countries, industries do not discharge their effluents directly into municipal sewers. In their case, the levy includes the cost of collection and cleaning up of the wastewater before it is allowed into water bodies.  It has been stated elsewhere that cleaning up urban effluents is expensive. Through this polluter-pays mechanisms, the municipalities in OECD countries are able to generate revenue that are needed for adequate clean up of all wastewater, thereby avoiding pollution of their aquatic systems which, if it happened, would undermine the services they obtain from them. And wherever accidental pollution occurs, the municipalities usually have adequate resources to undertake remedial action.  *Source: Economic Instruments for Pollution Control and Natural Resources Management in OECD countries, 1999.* |

There seem to be no case so far of application of PPP in the Nile Basin, despite the fact that many urban centers are located on the bank of the river or its tributaries; and it is more or less certain that some industries discharge pollutants into the river. The matter has not attracted much attention probably because of the low level of industrialization and/or because of low level awareness of the issues by the public. Nevertheless, Nile Basin countries would be well advised to pre-empt pollution by putting in place the right policies and legal frameworks that will prevent serious pollution, rather than wait until pollution has occurred.

As indicated above, legislation that allows PPP would not only serve as a disincentive to potential polluters, whereby they would process their effluents more efficiently; but it would also provide resources for necessary cleaning activities wherever pollution occurred.

Depending on the efficiency of their operations in treating their wastewater, candidates for participation in PPP in the basin include, for example:

* Wastewater managing companies, which in turn would work out a way of sharing the cost with their clients
* Industrial establishments which discharge polluted water into water bodies, for example, fish processing factories, coffee factories, abattoirs,
* Horticulture growing companies because of their heavy us of agrochemical which also end up polluting nearby water bodies.

**5.1.2: Application of Ecosystem Levies**

As stated earlier, urban communities enjoy ecosystem services, such as freshwater, water regulation and purification, recreation, education, and so on. Yet some members of the community use these services to establish profitable businesses from which they make huge profits. For example, water companies abstract water from rivers and streams flowing down from catchment areas; process the water and distribute it to make money. Tour companies on their part sell “products” within ecosystems to make profits, most of them with little regard for the health of the ecosystems; and hydropower generating companies dam rivers to generate electricity which they sell at profitable prices also with little regard for the origin of the water. The list goes on. All these businesses are exploiting ecosystem services the conservation of which they make no contribution.

There is, therefore, a good case for legislation that would allow for imposition of ecosystem levies, to be collected as tax by each government as Payment for Ecosystem Services (PES), so that the revenues generated can be used in the sustainable management of these ecosystems for the services rendered. As discussed below, PES is an incentive-based mechanism through which a catchment ecosystem can be conserved by the stewards of the land, thereby enabling the community to continue enjoying its services, while the stewards get “something” in return. The taxation approach is the most direct and simplest, whereby a tax or fee is charged on sales of a product that is associated with ecosystem services, and the proceeds go either to compensate the stewards or owners of the ecosystem, or to finance the management of the ecosystem, or both. Box 9 provides an example of where PES has been applied successfully.

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| **BOX 9: Application of PES for water provision in Costa Rica**  PES is being applied in Costa Rica as an arrangement between a public water company, Heredia, and landowners/farmers who have agreed to conserve forests on their land in the watershed in order for the utility company and its clients to continue obtaining watershed services in form of water. Prior to implementation of PES, there was pressure on the forests, whereby farmers wanted to turn them over into grazing land. If this had happened, the utility company and indeed all its client water users would have had a challenge of receiving adequate and clean supplies of water.  Following negotiation, a deal was concluded whereby the farmers agreed to conserve the forests in return for payment for the opportunity cost of utilizing their land for forest conservation. As most farmers would have used the land either for diary or ranching, the payments were based on the opportunity cost for diary or ranching.  The utility company raises the funds needed by adding a fee (currently of about US$ 0.20) onto each water user’s water bill, and consolidates the amount collected into a fund that is then responsible for sending cheques to farmers based on the amount of forest each is conserving. In addition to collecting money, the company puts a lot of effort into explaining to the community the purpose of the tax and the importance of conserving the forest.  The company has been monitoring the initiative and believes that PES has had a positive impact, in that overall, forest cover on private land has increased, thereby securing the ecosystem provision of water, while at the same time land owners are receiving income for their land.  Note: an important principle for PES is that in any payment arrangement, those who pay should be aware that they are paying for an ecosystem service that is valuable to them; and those who receive the payment should engage in meaningful and measurable activities to secure the sustainable supply of the ecosystem service in question.  This example also serves to illustrate the fact that once communities are made aware of the issues that affect them, they are willing to cooperate and even contribute funds in order to secure the sustainability of the services.,  *Source: What w are we learning from experiences with markets for environmental services in Costa Rica? By Rojas M and Aylward, 2003, IIED, London.* |

PES projects are also under successful application in China in their efforts to prevent further pollution of their water courses; in the Philippines to protect waterways where tourists go for kayaking; and in Vietnam to protect the catchment of the Dong river (Oliver and Emerton, 2008).

Although there are no recorded cases of PES in any Nile basin county, there is definite potential for its application. It is a model that could be “sold” to, for example, utility companies for them to operate privately as in the case of Heredia in Costa Rica; or a model could be adopted whereby countries levy PES and fees to profiteering users of ecosystem services. Alternatively, a hybrid model could be adopted whereby governments partner with private sector through public-private- partnership arrangements in which government and private sector combine efforts and resources in conserving ecosystems that are critical for provision of ecosystem services that they all enjoy.

Because of their interest in good and constant supplies of water candidates for participation in PES in the basin include, for example:

* Hydroelectric power generating companies
* Water processing and distribution companies
* Factories which use a lot of water

Both PPP and PES are an attempt to address the concerns that people have about the deteriorating state of the environment caused by pollution and general degradation of the environment. It would be fair and a demonstration of social responsibility for the polluting enterprises to contribute to the cost of cleaning up, and for the water-using enterprises to contribute towards the conservation of ecosystems that allow their water to flow.

For PPP and PES to work well, however, basin countries would need to be aware of the fact that in case of the Nile basin, most of the critical ecosystems are hosted in the upper catchment of the watershed whereas big water users are found downstream. In that case, there would be need to develop modalities for ensuring that the funds collected both upstream and downstream are put to the cause for which they will have been collected even across borders. However, that should not be a problem; for example a Trust Fund could be created into which PES and PPP funds are deposited and the proceeds then used to undertake activities aimed at conserving the ecosystems upstream, or cleaning them up where they have been polluted downstream.

**CHAPTER 6:**  **CHALLENGES AND WAY FORWARD**

**6.1: Challenges:** Implementing some of the options discussed in this paper will in some cases not be easy, neither for the NBI itself, nor for the member countries, especially for those options that would be new to the region. However, with political will, it will be possible to overcome the challenges. It is essential for policy makers to be aware of the following requirements and drawbacks associated with some of the proposed options.

**6.1.1: Polluter Pays and Levies:** As the examples from OECD countries shows, this is a widely applied incentive in those countries and the resources obtained have helped to clean up water courses that had previously been polluted, and also to prevent further pollution. However, if communities and private sector are not adequately sensitized, a perception could be created that the levy is just another form of tax and therefore to resist it. OECD countries have been able to successfully introduce different types of levies on account of a number of measures they took, such as:

1. Engaging in effective advocacy on the causes and impacts of pollution and responsibilities of communities concerned.
2. Developing capacity to demonstrate point pollution for polluting industries, and being able to put a reasonably accurate cost to the pollution.
3. Acting transparently in the way the levies are used – ensuring that they are used for mitigating pollution and not diverted to other pursuits.

These three measures seem to be prerequisites for any system that engages in polluter-pay or other incentive schemes, suggesting that Nile basin countries would need to develop similar measures for their own schemes.

**6.1.2: International carbon markets:** These markets, especially the arrangement under the Clean Development Mechanism (CDM) have the potential for the double benefit of conserving ecosystems and therefore securing ecosystem services, while at the same time providing financial in-flaws for the stewards of these natural resources (land owners, communities and governments). However if not carefully handled, they could lead to serious disadvantages:

1. They can be harmful to the environment itself if, for example, exotic species of trees are used. A good example is the use of pine which does not allow undergrowth and hence, does not support local biodiversity. Its use in PES projects could be counterproductive to forest ecosystem.
2. Most carbon market schemes are still voluntary, and therefore require a lot of negotiation and diplomacy. Whilst that is itself not a disadvantage, for there to be a win-win situation, it requires that there is requisite capacity for both sides of the negotiation. In other words, Nile basin countries will need to invest in capacity building in this area if they are to derive benefits from carbon market schemes.
3. CDM projects are by definition long term; hence they cannot work in situations of doubtful tenure of land and resources on it. For CDM projects to achieve the intended objectives, there must be security of tenure of the land and resources in question. In some countries in the Nile basin, tenure issues still abound. A case in point is the ownership of wetlands in most of the basin. Most of them are not surveyed and their ownership not clear. These issues would need to be addressed before they can benefit from CDM.
4. The CDM seems to be still limited to the conservation of forests; and although there is likelihood that wetlands will soon be included, the proposal will need strong support from governments if it is to pass easily. Owing to the fact that wetlands abound in the Nile basin, it is in the interest of NBI members to support their inclusion under the CDM, so as to enable them benefit from the mechanism.
5. In order for them to function properly, all these schemes require specific policy and legal frameworks that ensure transparency and good governance. Nile basin countries will need to put in place appropriate policies and laws to govern the schemes as part of the process, and to adhere to them.

**6.2: Roles for Nile Basin secretariat:** The following are seen as the roles that the NBI should play to spearhead the conservation of ecosystem services in the basin:

1. Valuing of ecosystem services. Valuation of ecosystem services is a widely used tool in assigning economic value to different ecosystem services and therefore to make a case for conservation of ecosystems. Although some ecosystems in the Nile Basin have been valued, the methods used and timeframes differ so much that the results are probably not comparable. NBI should take charge of a valuation process that would produce comparable results and instill confidence in the outcome.
2. Bearing in mind that what happens upstream also has consequences downstream, there is need for NBI to facilitate research in likely effects of climate change and their impacts on ecosystems and livelihoods of people living in the Nile basin. Presently there are scattered initiatives. NBI should at the very least facilitate coordination and collaboration, in order to get more reliable outputs that apply across the basin.
3. Similarly, NBI should facilitating research into pollution – assessing pollution levels, determining sources of point pollution, valuing damage due to pollution especially in upstream water bodies for which impact the impact is also expressed downstream.
4. Facilitating the development of basin-wide water quality standards, putting in place a monitoring framework, as well as a remedial protocol.
5. Promoting PPP and PES as new approaches to ecosystem conservation, and facilitating the development of policy and legal frameworks for these incentive schemes, and modalities of how they would work across countries.
6. Developing modalities for creation and management of an Ecosystem Fund

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