FINAL REPORT

GLOBAL AND REGIONAL PUBLIC GOODS IN WATERSHED MANAGEMENT

The Eastern Nile Subsidiary Action Program
Watershed Management Project

Submitted to

Eastern Nile Technical Regional Office
Nile Basin Initiative
Addis Ababa, Ethiopia

A. J. James, PhD

18 DECEMBER 2005

Pragmatix Research & Advisory Services Private Limited
520 Galleria, DLF City Phase IV, Gurgaon 122 002, Haryana, INDIA
ajjames@pragmatix.co.in
+91 (0) 124 410 1493

CONTENTS

ACRONYMS USED

BCA	Benefit Cost Analysis
CVM	Contingent Valuation Method
EBCA	Environmental Benefit Cost Analysis or Assessment
EIRR	Economic Internal Rate of Return
EN-SAP	Eastern Nile Subsidiary Action Programme
FIRR	Financial Internal Rate of Return
GEF	Global Environmental Facility
ICR	Implementation Completion Report
IDEN	Integrated Development of the Eastern Nile
IRR	Internal Rate of Return
IWRM	Integrated Water Resources Management
NBI	Nile Basin Initiative
NEL-SAP	Nile Equatorial Lakes Subsidiary Action Programme
NPV	Net Present Value
PAD	Project Appraisal Document
SAP	Strategic Action Programme
SMU	Social Marginal Utility of Income
SWC	Soil and water conservation
WTP	Willingness to pay

Figure 1: The Nile River System
Source: www.thewaterpage.com/images/nilebasin.gif

SUMMARY

Context

The fast-track Watershed Management sub-Project aims to work on selected watersheds along 6 rivers in Ethiopia and Sudan, as the first part of the multi-project Eastern Nile Subsidiary Action Program (EN-SAP) under the multi-country Nile Basin Initiative (NBI). The objective of these projects is to address the current problems of land degradation, soil erosion, sedimentation and soil fertility loss within these watersheds, by improving the standards of living of the population, decreasing population pressures and increasing land productivity.

Potential public good benefits

Such an initiative is likely to confer local, regional and global benefits. Local benefits are expected in terms of improved output and income from agriculture, forestry and alternative livelihood measures as well as decreased costs, time and effort in collecting fuel wood, fodder and water. Part of the regional benefits would be the more tangible benefits of reduced sedimentation in existing and planned reservoirs downstream, increased life of these reservoirs, improved hydro-electric power generation potential, and more water for domestic purposes and irrigation. In addition, the planned interventions can also result in 'public good' type of benefits – which can be enjoyed by all without decreasing the availability for others, and from which no others can be excluded. Such potential regional public good benefits are the prevention of increases in flood damage (by arresting the rise of river beds due to sedimentation), increased potential for recreational facilities, preservation of bio-diversity, improved aesthetics of downstream water bodies and ecosystems, and better preservation of the functioning of these downstream ecosystems. Watershed management interventions can also be expected to confer global public good benefits such as preservation of biodiversity and option value, and carbon sequestration (which reduces the build up of greenhouse gases that affect global warming).

Valuing public goods

There are two broad categories of measures developed to value public goods, namely market based methods and survey-based methods. Of these, survey-based method of contingent valuation (CV) is most suited to capture potential regional public good benefits. A CV study involves constructing two or more hypothetical scenarios (e.g., different levels of improvement in upstream watershed management), identifying potential benefits from each of these (e.g., lower sedimentation in downstream reservoirs, reduced flooding damage, improved recreational and aesthetic benefits), and asking respondents how much they would be willing to pay for such benefits. The CV study however needs to be high-quality, given the several methodological problems that need to be overcome to obtain reliable results, and is therefore likely to be expensive. Nevertheless, several good CVM studies have been carried out in developing countries (including Africa) and it is certainly a feasible option in the present context.

Benefit cost analysis

A Social Benefit Cost Analysis systematically compares the likely costs of the project with the (incremental) economic value of potential social and environmental benefits. The project will be adjudged economically viable given a positive 'net present value' of the net benefits. Net present value or NPV is obtained by discounting the time stream of incremental net benefits by an appropriate rate of discount. Another measure of economic viability is the economic 'internal rate of return' or EIRR of the project, the interest rate that equates potential project benefits with potential project costs. Environmental

benefits, when added to conventional BCA, can increase NPV and EIRR significantly. The EIRR, however, is sensitive to changes in the discount rate used, the expected benefits (including the potential public good benefits), and delays in expected benefit streams, and this needs to be checked as part of evaluating the economic viability of the project. In the World Bank-supported Loess Plateau watershed project in China, for instance, the NPV increased from 19 to 22% simply by adding the potential environmental benefits of reduced sediment transfer downstream. Also in the World Bank-supported Natural Resource Management Project in Armenia, the NPV increased by 130% and the IRR by 4 percentage points when local and global environmental benefits were included in the analysis.

Distributional considerations

Potential benefits to poor stakeholders can be 'adjusted' to reflect the higher social marginal utility of such (income) benefits. Such adjustments will reflect in all measures of economic viability, including the net present value of expected project benefits and the EIRR. This has been done, for instance, in the Benefit Cost Analysis of a river clean-up programme in India (the Ganga Action Plan).

Impacts on proposed EN-SAP projects

An effective watershed management sub-project should also increase the potential impacts, benefits and economic viability of the other sub-projects being planned under the Integrated Development of the Eastern Nile (IDEN) project. Reduced sediment transport will increase the life of proposed hydro-electric projects, reduce future reservoir dredging costs and reduce the damages from future flooding, while more water flow downstream will improve the efficiency and efficacy of hydro-power generation.

Financing options for the watershed management sub-project

There are basically five options for generating the funds required to implement the watershed management sub-project: (1) national governments (of Sudan and Ethiopia) pay in proportion to expected national costs or benefits; (2) citizens of each country pay through taxes or special collections and in proportion to expected national costs or benefits; (3) potential beneficiaries in each country make contributions to the project according to the proportion of expected costs or benefits; (4) national governments borrow from international financial institutions in proportion to expected national costs – and repay partly from general taxes and partly from beneficiary contributions; and (5) donors give grants for specific components or activities. Collecting contributions from potential beneficiaries (from expected economic benefits), however, is widely regarded as necessary for the sustainability of project interventions and benefit streams. In the China Loess Plateau case, for instance, nearly 60% of total project costs were collected as community contributions from actual or potential increases in economic benefits. In the present case, however, a combination of options may be best.

1. INTRODUCTION AND BACKGROUND

1.1 CONTEXT

The Nile Basin Initiative (NBI) is a partnership launched in 1999 between the nine countries that share the waters of the Nile and its tributaries.[1] To realise its Shared Vision of *achieving sustainable socio-economic development through equitable utilization of, and benefit from, the common Nile Basin water resources*, the NBI developed a Strategic Action Programme (SAP) comprising (1) the Shared Vision Program and (2) two Subsidiary Action Programmes, one each in the Nile Equatorial Lakes Region and the Eastern Nile Region. The Eastern Nile Subsidiary Action Programme (ENS-AP) comprises a large longer-term, multi-purpose, high-impact, multi-country program of investment, as well as a set of strategic 'fast track' projects, aimed at demonstrating early results on the ground and tangible benefits from cooperation. Up to two fast track watershed management projects are to be developed in each of the Eastern Nile countries, viz., Egypt, Ethiopia and Sudan.

1.2 STUDY OBJECTIVES

This study aims to define how the public good concept is best applied to watershed management and to provide practical ways to assess (i) the extent to which watershed management projects will generate regional and global public goods in the Nile Basin and (ii) how these public goods will affect the economic performance and justification of six other EN-SAP projects envisaged, the distribution of benefits and costs within the project area, and the eligibility and access to funds from funding sources for envisaged projects.

1.3 STUDY SCOPE & METHODS

Since this is a short term assignment that does not permit gathering of empirical data, the study is based on a secondary literature review of other similar projects and studies.

1.4 STRUCTURE OF THE REPORT

The next section contains a brief overview of the context, including the Nile Basin Initiative, the Eastern Nile Subsidiary Action Programme (EN-SAP), and the various sub-projects planned under the Integrated Development of the Eastern Nile (IDEN) Project. It also describes the objectives, expected components and expected outputs of the EN-SAP Watershed Management Sub-Project. Section 3 overviews some basic concepts of watershed management, including typical watershed development interventions, and different approaches to watershed management, including participatory project implementation, agro-ecosystem analysis, watershed plus, rural livelihoods, watershed externalities and integrated water resource management. It concludes by detailing the key characteristics of the proposed EN-SAP watershed management project within this context. Section 4 describes the potential local and public good benefits of the proposed watershed management project. Section 5 details practical methods to be used to measure the economic value of these benefits, and also details applied benefit cost analysis. Section 6 describes a straightforward method to adjust time streams of potential project benefits to reflect distributional issues, illustrating its application in a hypothetical case. Section 7 describes how the proposed watershed management project is likely to affect the other 6 sub-projects, and takes a pragmatic look at the prospects for Integrated Water Resources Management (IWRM) in developing countries. Section 8 considers potential funding options for the proposed watershed management sub-project, while Section 9 concludes.

[1] See Figure 1. Details of the NBI and the EN-SAP are given in Annexure 2.

2. THE EN-SAP WATERSHED MANAGEMENT SUB-PROJECT

2.1 INTRODUCTION

This section presents an overview of the seven sub-projects proposed Eastern Nile Subsidiary Action Program (EN-SAP), and details the watershed management programme, the fast-track option being considered for immediate implementation.

2.2 THE NILE BASIN INITIATIVE

The Nile Basin Initiative (NBI) is a regional partnership set up in 1999 between the nine Nile basin countries of Egypt, Ethiopia, Sudan, Uganda, Tanzania, Democratic Republic of Congo, Kenya, Rwanda and Burundi to provide a forum for the cooperative development of the water resources of the Nile River. The NBI aims to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources. More specifically, the NBI aims to

1. Develop the water resources of the Nile in a sustainable and equitable way to ensure prosperity, security and peace for all its people;
2. Ensure efficient water management and the optimal use of the resources;
3. Ensure cooperation and joint action between the riparian countries, seeking win-win gains;
4. Target poverty eradication and promote economic integration; and
5. Ensure that the program results in a move from planning to action.

To this end, the NBI has various programmes encompassing the following thematic areas:

- Water
- Biodiversity
- Poverty eradication
- Forests
- Drought
- Institutional framework for sustainable development
- Energy for sustainable development
- Agriculture
- Protecting and managing the natural resource base of economic and social development
- Sustainable development for Africa
- Changing unsustainable patterns of consumption and production
- Sustainable development in a globalizing world

The NBI has two major investment programs: The Eastern Nile (EN-SAP) currently includes Egypt, Sudan and Ethiopia; while the Nile Equatorial Lakes Region (NEL-SAP) includes the six countries in the southern portion of the Basin, as well as the downstream riparian Sudan and Egypt. These subsidiary groups have identified joint investment opportunities which warrant further investigation and preparation.

2.3 THE EASTERN NILE SUBSIDIARY ACTION PROGRAM (EN-SAP)[2]

These Eastern Nile countries are in the process of developing a major and complex multi-purpose multi-country investment programme for the region as a whole. As a first step towards developing this regional, integrated, multi-purpose programme, ENSAP has launched the first project – called the Integrated Development of the Eastern Nile (IDEN) - aimed at demonstrating tangible gains. IDEN comprises seven sub-projects (Table 1).

[2] This section is based on ENCOM (2001), the website www.nilebasin.org, and the Terms of Reference of this study, which is available in Annexure 3.

Table 1: Proposed sub-projects of the IDEN Project

Integrated Water Resources Management	1. Baro-Akobo Multipurpose Water Resources Development Sub-Project
	2. Eastern Nile Planning Model Sub-Project
Flood and Drought Management	3. Flood Preparedness & Early Warning Sub-Project
Hydropower Development and Regional Power Trade	4. Ethiopia-Sudan Transmission Interconnection Sub-Project
	5. Eastern Nile Power Trade Investment Program
Irrigation & Drainage Development	6. Irrigation and Drainage Sub-Project
Watershed Management	7. Watershed Management Sub-Project

Most of these are long-term and there is an urgency to demonstrate progress on the ground. Therefore ENSAP has decided to fast-track the watershed management programme, in 6 selected rivers of the Nile Basin in two countries, Sudan and Ethiopia, focusing on integrated soil and water conservation interventions.

2.4 ENSAP WATERSHED MANAGEMENT PROGRAMME

Any intervention designed to address watershed management in Ethiopia and Sudan must be designed to address the root causes of land degradation, soil erosion, sedimentation, and soil fertility loss. In view of the multi-sectoral nature of the problem (land degradation, fuel wood demands, population pressures, illiteracy, lack of alternative sustainable livelihoods, etc.) a comprehensive and integrated approach is required, as traditional watershed management actions, in this case, would treat the symptoms, as opposed to address the root causes which lead to the spiral of degradation and poverty. However, while the impacts of interventions to address the range of relevant root causes will take a longer timeframe in order to cause lasting change, watershed management interventions need to be initiated as soon as possible.

An overriding regional significance of this project will be erosion control leading to decreased siltation and sedimentation in downstream river/reservoir reaches which will increase reservoir life, improve hydropower production and irrigation efficiency, as well as protect critical aquatic habitats. A second important regional benefit, which the sub-project will generate, is an overall increase in land productivity, which will yield higher agricultural outputs, and thus enhance food security and alleviate poverty.

Objectives

The development objective is to improve standards of living of the population living within selected watersheds in the Eastern Nile region, decrease population pressures and increase land productivity so that sustainable livelihoods and land use practices can be secured for the target populations. The immediate objective is to establish a sustainable framework for the management of selected watersheds on the Tekeze, Atbara, Mereb[3], Abbay/Blue Nile and Baro Akobo/Sobat rivers in Ethiopia and Sudan, in order to improve the living conditions of the people, enhance agricultural productivity, protect the environment, reduce sediment transport and siltation of infrastructure, and prepare for sustainable development oriented investments.

Expected Components

The following components are envisaged:

[3] This basin is shared with Eritrea, which is not a participant in the ENSAPT program.

- Agricultural sector capacity strengthening. The Eastern Nile Irrigation and Drainage Development sub-project is addressing institutional and legislative reform issues in the agricultural sector. The Eastern Nile Watershed Management sub-project will support the Irrigation and Drainage Development sub-project in the institutional and legislative reform component, with activities focusing specifically on the institutional and policy implications of watershed management actions.
- Watershed management investment program. A range of integrated measures in any given area will be addressed in order to increase agricultural yield and decrease erosion tendencies. Based on findings of project preparation, the watershed management investment program may include a range of interventions, including some or all of the following: capacity building and institutional strengthening of agricultural and forestry sectors at national and regional levels; research and development in collaboration with on-going activities and collaboration with existing institutions; measures to address integrated soil and water conservation; and increased collaboration between institutions and national agencies and local governmental and non-governmental organizations addressing population policies, health and nutrition. Specifically, integrated soil and water conservation efforts will *include* activities to support catchment conservation through reforestation and agroforestry and protection of existing forest stands; water harvesting and improvement of rainfed agriculture production in project areas (including crop diversification and sustainable farming techniques); and improved grazing practices.
- Erosion and Sedimentation study. Based on the Rapid Erosion and Sedimentation Assessment which will be carried out as part of the project preparation activities, additional investigations will be undertaken during the project to assess and project sedimentation reduction impacts as a result of measures to control soil erosion in the project areas.
- Population and carrying capacity. This component will address four main issues in the context of the integrated IDEN project (i) population policies, (ii) education, literacy and the girl child, (iii) alternative livelihoods and out-migration, and (iv) a carrying capacity and population density study (building on existing studies).
- Community based Energy Alternatives. Based on the energy option past experience review, an energy program will be developed. Energy options with past demonstrated successes will be introduced.
- Assessment of Morphological Changes in the Eastern Nile. Morphological changes, as manifested in river meandering, sediment deposition, river bed degradation, and bank erosion, seriously impact the Main Nile. There is a need, therefore, to conduct surveys and further studies to assess involved factors, to predict short and long term impacts, and to determine the necessary remedial measures.

Expected Outputs

The following outputs are expected from the EN-SAP Watershed Management Sub-Project:

- Decreased land conversion and increased land productivity
- Sediment load reduction
- Poverty alleviation and improved alternative livelihoods
- Availability of alternative fuel sources
- Institutional strengthening
- Reduced population pressure
- Improved rangelands

The next section places the proposed EN-SAP watershed management sub-project within the various approaches to watershed management.

3. WATERSHED MANAGEMENT

3.1 INTRODUCTION

Typical watershed interventions aim to enhance bio-physical features of a watershed, such as biomass production (including livestock), water and sediment flows and ecosystem features. An agro-ecosystem perspective, however, seeks to optimize additional socio-economic objectives, including livelihoods, standards of living and social equity. There is also a distinction between watershed development, usually limited to designing interventions to enhance bio-physical features, and watershed management which can include a range of multiple objectives from only managing the natural resource base, to community participation, poverty alleviation and sustainable rural livelihoods to integrated water resource management.

3.2 WATERSHED DEVELOPMENT

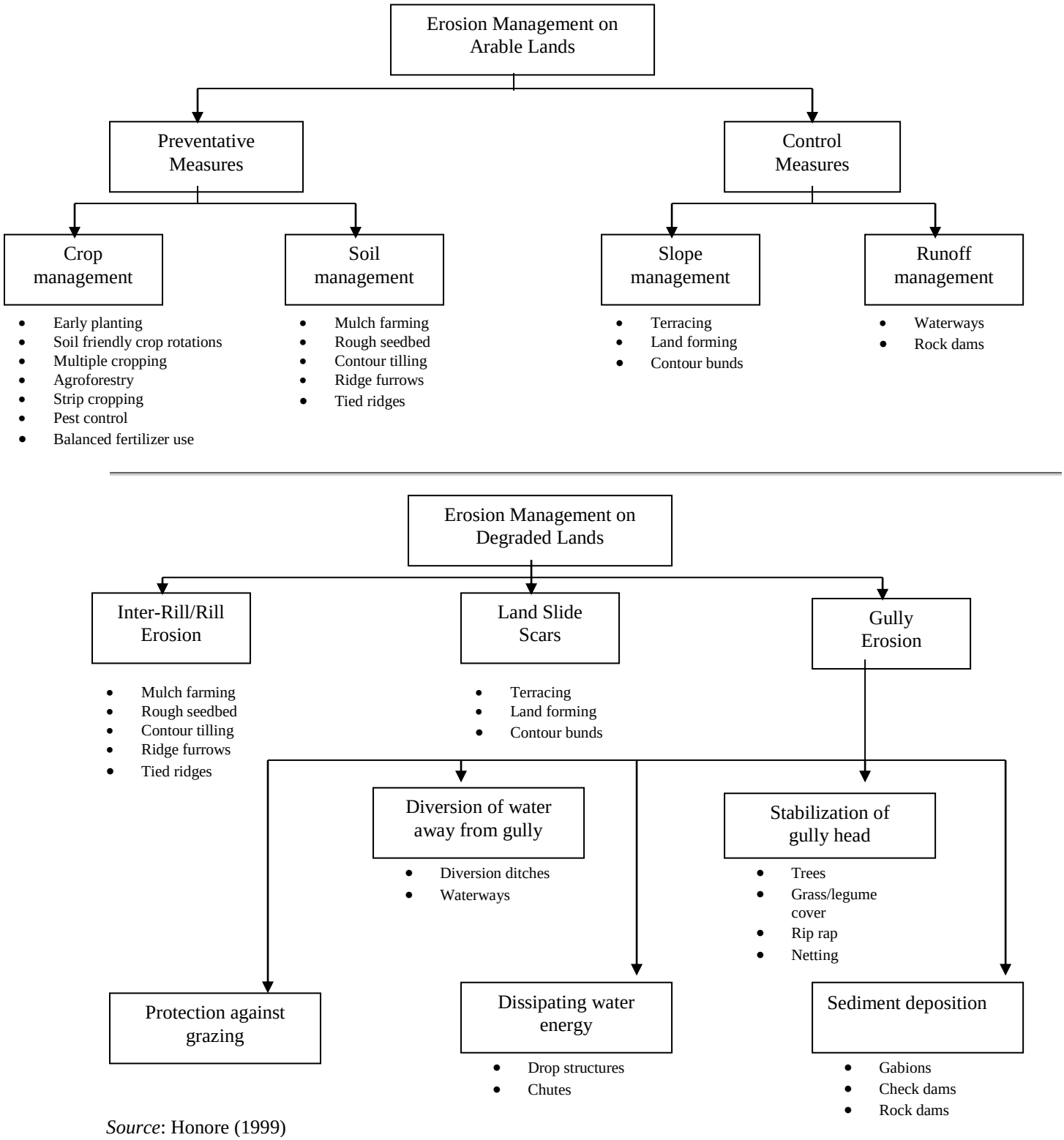
Watersheds are defined formally as the specific land area that drains water to a common point, such as a river of other water body. Watersheds may be further divided into smaller mini-watersheds and micro-watersheds, based on smaller drainage lines such as streams and tributaries of larger rivers (In India, for instance, 500 hectares is usually taken as a broad rule of thumb to define micro-watersheds). There are, thus, strong hydrological linkages between upstream and downstream areas within watersheds. This affects both problems and interventions to address these problems. For instance, deforestation and over-grazed pastures in upper reaches of a watershed can increase runoff velocity along natural drainage channels, causing soil to erode and deposit in downstream water bodies. Similarly, control of deforestation and pastureland development in upstream areas can reduce damage along the banks of natural drainage channels, as well as sediment transport and thus reduce silt deposits in downstream reservoirs.

Watershed development projects are usually undertaken to ameliorate physical problems in the watershed, such as deforestation, soil erosion, desertification and rangeland degradation. Physical project interventions generally comprise soil and water conservation, water resource development, forest protection and reforestation, and rangeland management.

Soil and water conservation (SWC) involves land-treatment to reduce soil erosion damage and silt transport, improve nutrient uptake by crops and improve recharge of groundwater. SWC interventions include a wide-range of measures from levelling and bunding of private farmers' fields and improved crop management practices to interventions on public land, such as drainage-line treatment such as building gabion structures, loose-boulder, earthen or concrete weirs to reduce the velocity of water flowing through natural drainage channels, contour trenching terracing, and ridge furrows to maximise in-situ water conservation (see Figure 2 for a range of measures to control soil erosion).

Water resource development at the micro-watershed level may be broadly divided into three: (1) repairing, desilting and cleaning existing rain water harvesting bodies; (2) constructing earthen or concrete rain water harvesting structures (check dams) to capture and store surface water, and (3) constructing and percolation tanks to recharge groundwater aquifers with rain water. These measures improve the availability of surface and groundwater to local communities, and provide additional water for irrigation, domestic purposes (drinking, cooking, washing, cleaning), small-scale productive uses (including livestock, vegetable gardens, beer-brewing, tea making, pottery, brick-making).

Figure 2: Erosion management treatments on arable and degraded areas



Source: Honore (1999)

Forests play a vital role in enhancing soil and water flows within watershed. Forestry sector interventions can be broadly divided into measures to protect existing forests, plantations to replace degraded forest areas and agroforestry. Where there are existing forests, protection measures include fencing or trenching to reduce open grazing by livestock in existing forest areas. Reforestation through plantations may be undertaken in denuded forest land and other vacant common or private land, and supplemented by protection measures. The elimination of 'alien' species of forests to protect the development of indigenous species is another management practice. Agro-forestry involves planting trees either within fields or on field bunds, where they protect top soil from wind soil erosion damage.

Rangeland provides grazing land for free ranging livestock. Measures to protect and enhance range land from erosion or over-grazing include protection measures such as trenches or fences, moving from open grazing to stall feeding (cut and carry), and plantation of improved grass species (such as *vetiver*).

3.3 WATERSHED MANAGEMENT

Different approaches have been developed to watershed management, which goes beyond merely investing in watershed development interventions as described above.

Agro-ecosystems: Well-designed watershed development interventions can improve land productivity, increase carrying capacity of pastures and reduce damage due to soil erosion and the siltation of downstream water bodies. Such a bio-physical view of watershed interventions tends to neglect the socio-economic dimensions, and led to the development of the notion of agro-ecosystems (Conway, 1981). Agro-ecosystems viewed natural ecosystems (and watersheds) as units that aimed not only to optimize water and nutrient cycling with ecosystems, but also land productivity, profitability and social equity. Conway (1987) describes this process as maximising multiple objectives: productivity, stability, sustainability, and equitability, based on the bio-physical potential of the 'agro-ecosystem'. But this does not explicitly consider the issue of externalities.

Watershed-based rural development, as practised for instance in India from the mid-1990s seeks to graft a poverty-alleviation programme onto a natural resource conservation programme. The main benefit to the rural poor is short-term wage-labour opportunities in soil and water conservation activities although consequent increases in cropping intensity may yield agricultural labour opportunities in the longer term. But a whole range of supplementary rural development activities may be grafted on to a watershed based rural development programme, including credit and saving groups, micro-enterprise development (including non-land based and land-based income generating programmes), health, hygiene, sanitation and education programmes.[4]

Participatory watershed development: Till about the 1980s, watershed development was the preserve of technical experts seeking to develop the natural resource base. Participatory approaches to watershed development sought to place local stakeholders at the centre of planning, implementing and monitoring watershed development interventions. Such community participation increases local ownership and responsibility for the success of interventions and is particularly important, for instance, in adopting and enforcing social controls in forestry and rangeland interventions (including 'social fencing'), and addressing social equity issues in the distribution of costs and benefits from watershed interventions.

Rural livelihoods programmes: The Department for International Development (DFID) developed the concept of Sustainable Rural Livelihood which has been implemented since

[4] There are several examples of donor-assisted and government-implemented 'watershed development programmes' in India. For a discussion of these issues, see Farrington, Turton and James (1999).

the late 1990s in a range of programmes (www.livelihoods.org). Such an approach broadens the approach to make stakeholders central to all interventions, both as implementers and beneficiaries. This also evaluates the pressures on stakeholders to degrade, and conversely, the nature of interventions required to move them towards more sustainable resource use patterns. Innovative interventions have included participatory technology development (of new seed varieties), micro-credit groups, micro-enterprise development and migration support programmes (see, for instance, Farrington et al., 1999).

Watershed-plus: The concept of 'watershed plus' was developed in the Indian context in the late 1990s in order to address stakeholder demands for interventions in other sectors, including infrastructure and behavioural change in the sectors of sanitation, health and education, and need-based public infrastructure such as street lights, culverts, causeways and public meeting halls (Farrington et al., 1999).

Externalities in Watersheds: Externalities are an important feature of watershed development. An externality is said to occur when 'the activities of one person affects the welfare or production functions of other people who have no direct control over those activities' (Dorfman and Dorfman, 1993). Externalities are widespread in watersheds due to (a) hydrological linkages between upstream and downstream use of natural resources, and (b) socioeconomic linkages across property boundaries and common lands. If one person owned the whole watershed, externalities within the watershed would not be a problem, since externalities by definition involve multiple parties. With multiple land owners within a watershed, however, human interventions that change land uses could spread local and external costs and benefits unevenly among different people. Watershed externalities are inefficient because they prevent the most productive overall land use from being put in place, and they skew the distribution of benefits among land users. Thus, while watershed development is relatively straightforward from a technical and biophysical perspective, it can be extremely complicated from a socioeconomic viewpoint (Kerr et al., 2004). Externality-based frameworks are not common in watershed management, and are only being understood, documented and evaluated relatively recently.

Integrated water resource management: This approach takes a water perspective to development, and seeks the integrated development and management of all water-using sectors including surface water and groundwater, domestic water supplies and irrigation, urban, rural and peri-urban water supplies (GWP, 2000). Multi-purpose water development and management of river basins has been in existence for some time in France, and Germany, and in Australia, while developing countries are only moving towards this approach.

A watershed management programme, within this context, is only part of a larger basin-wide integrated water, soil and biomass management programme. This is a far more complex process than mere watershed development – as it involves not only managing externalities, but also managing the natural resources of the watershed so as to maximise social welfare of all stakeholders affected by the watershed in question. This includes not just downstream uses of a shared river like the Nile, but also people in other parts of the world who may be affected by actions such as the preservation of local habitats to protect biodiversity, including rare or endangered species of flora and fauna.

Watershed management: Beyond conventional watershed development that seeks to develop the soil, water and biomass in the physical watershed, watershed management seeks to address other objectives based on stakeholder perspectives. These can range from addressing social equity in the distribution of benefits and costs of watershed developments (e.g., through externalities), to addressing underlying causes of stakeholder poverty and resource degradation, to supporting rural livelihoods by addressing the joint

development of other 'non-watershed' sectors, to integrating watershed development and management within the entire river basin.

3.4 THE EN-SAP WATERSHED MANAGEMENT SUB-PROJECT IN PERSPECTIVE

The EN-SAP Watershed Management Sub-Project aims to implement a range of integrated measures in selected watersheds on 6 rivers in Ethiopia and Sudan, to increase agricultural yields and decrease soil erosion, but to go beyond mere watershed development interventions. Specific measures are to be decided during the project preparation exercise. The key characteristics of the watershed management programme, however, are likely to be the following:

- Participatory approaches to implement watershed development measures, including catchment conservation through soil and water conservation (to reduce sediment loads), reforestation and agroforestry and protection of existing forest stands (to improve the availability of alternative fuel sources), water resource development and improvement of rainfed agriculture production including crop diversification and sustainable farming techniques (to decrease land conversion and increase land productivity), and improved grazing practices (to improve rangeland carrying capacity and to reduce livestock pressure).
- Limited rural livelihoods approach focusing on addressing improving the living conditions of the people, including alternative livelihood options for poverty alleviation, but not addressing underlying causes of poverty, resource degradation and land and water use patterns.
- Integrated Water Resource Management approach to develop a sustainable framework for the management of selected watersheds, which should include an evaluation of externalities.

The benefits expected from these measures are discussed in the next section.

4. POTENTIAL BENEFITS

4.1 INTRODUCTION

The main watershed interventions being considered for the EN-SAP watershed management sub-project are expected have local benefits as well as more distant public good-type benefits.

4.2 POTENTIAL LOCAL BENEFITS

The proposed interventions are likely to impact local stakeholders in two broad ways: (1) increased incomes from land, livestock and alternative sources and (2) reduced expenditure, time and effort to collect forest and rangeland produce and water.

Output and income increases

Agricultural production: Crop yields are expected to increase in both rainfed and irrigated land due to several factors including field-level conservation of top soil (through reduced erosion), improved soil quality (through cropping techniques), better seed varieties, and better water availability and management. Crop production is expected to increase as well, both on account of increased yields from rainfed and irrigated agriculture as well as expansion of irrigated area and reduced post-harvest losses due to pests (addressed through integrated pest management interventions). The transformation of this increase in agricultural production into stakeholder incomes will, however, depend on the quantum of market sales and output prices.

Forest outputs: Reforestation and protection of existing forests should increase the availability of timber, fuel wood, grasses, and a range of minor forest produce including barks, fruits, roots, leaves, medicinal herbs, to supplement incomes (through sales of direct or processed outputs) and home consumption. Again, increases in forest incomes will depend on local market conditions and marketable surplus.

Livestock production: Rangeland management to improve fodder availability should increase the milk and meat yields of existing livestock and support additional livestock. This could lead to Increases in income from livestock.

Alternative livelihoods: Successful interventions to provide alternative income generating options should augment local incomes, although this depends to a large extent on factors such as market opportunities, transport facilities, quality control, and skills in negotiating prices.

Reduced costs, time and effort

Crop production: If private farmers have spent money, time or effort in protecting their fields from soil erosion damage, there could be cost savings as a result of watershed management interventions. Similarly, the introduction of bio-pesticides and bio-fertilisers can reduce costs of chemical fertilisers, if used.

Domestic water collection: The increased capture of rainwater through water harvesting structures should increase the local availability of water for domestic purposes. With suitable infrastructure to tap surface and groundwater, access to domestic water supplies should increase. This should save the community (especially women and children) the time and effort to collect and bring back water for domestic purposes. If water is purchased (as is the case in several parts of water-scarce semi-arid rural India), this should reduce household expenditures on buying drinking water.

Fuel wood collection: If wood is the main fuel source, increases in fuel wood plantation and existing stocks through reforestation and conservation should increase the availability of fuel wood. This should reduce the time and effort spent on collecting fuel wood, as

local scarcity increases the distance travelled, and thus the effort and time taken, in finding new sources of fuel wood. If small-scale bio-gas plants are part of the intervention measures, taking advantage of increased livestock production, this should provide a supplementary source of fuel for household needs. Such measures could decrease any household expenditures currently being incurred on buying fuel for cooking.

Fodder collection: Rangeland and forestry interventions should improve the production of grasses. Although this will improve the availability of locally available fodder for open grazing, introducing cut-and-carry systems for stall feeding may be a part of the rangeland and forest protection measures adopted. However, increased local fodder availability will still involve less time spent in fodder collection, leaving more time say for household chores and alternative income generating options.

Measures to value these potential local benefits are discussed in the next section. Suffice it to point out here that the extent of these potential benefits to local stakeholders depends greatly on local resource and socio-economic conditions.

4.3 PUBLIC GOOD BENEFITS

Successful watershed management can result in a range of benefits called 'public good-type' of benefits. The economic definition of a public good is one which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good.[5] In the watershed management context, this refers to goods and services in that one user cannot stop others from benefiting from (e.g., reduced downstream siltation or flood damage from better upstream control interventions), and one person's consumption (e.g., of improved flood control) does not reduce the benefits enjoyed by another. Another way of looking at these is the following: flood damage or increased sedimentation of downstream reservoirs is public-good type of *problems*, and their successful resolution which creates public-good type of benefits.[6] Such public goods can accrue to regional or global stakeholders.

Global public goods: 'Global' pollution problems and loss of biodiversity are examples of global public good-type problems. Pollution abatement or preservation of biodiversity is public good benefits that accrue to large number of people. Another example of global public goods is the 'non-user' benefits enjoyed by those who do not directly use the resource. The famous clean-up of the river Thames in London, the ecological restoration of the Rhine in Germany and clean up programme of the river Ganga, for instance, generated substantial 'non-user' benefits.[7] Control of climatic change is also a global public good but confers 'user' benefits for the entire international community.

Regional public goods: Some public goods may only affect people within a region. The restoration of environmental services of a local ecosystem, successful flood protection measures, effluent and sewage treatment plants (that lead to improved water quality in rivers and other 'public bodies'), which are all benefits that may be termed 'regional'

[5] 'Public goods' refer to a class of goods and services characterized by non-exclusion (no consumers can be excluded from using it) and non-reduction (one consumer's consumption does not decrease the availability for another consumer). Private goods, on the other hand, are characterized by exclusion (those with property rights can effectively exclude others from consuming the good) and reduction (one person's consumption will reduce the availability to others. There are also quasi-public goods, i.e., goods that exhibit some of the properties of pure public goods, and some properties of pure private goods.

[6] Note that these are not strictly 'public goods' and some are in fact quasi-public goods. In general these are better termed 'public good-type of benefits'. For the sake of simplicity, however, these are referred to hereafter as simply 'public goods.'

[7] Only the government clean-up programme of the Ganga (called the Ganga Action Plan) has, however, been subject to detailed environmental benefit cost analysis (Markandya and Murty, 2000)

public goods, since they are public goods that affect more than just the direct users of the environmental resource, but not all non-users.

4.4 POTENTIAL PUBLIC GOOD BENEFITS

Several regional and global public goods can be identified for the proposed watershed management sub-project, but details will depend on local conditions and the nature of proposed interventions.

Regional public good benefits

Reduced sedimentation in downstream reservoirs: This is a potential benefit of integrated soil and water interventions in upstream areas, and can reduce dredging costs incurred by reservoir management to maintain water holding capacity. For reservoirs being planned in the future, the current watershed management projects will reduce future dredging costs.

Increased life of reservoirs: Reduced sedimentation will also help arrest the sediment build up which could otherwise threaten the life of downstream reservoirs.

Improved hydro-electric power generation: Current and proposed multi-purpose hydro-electric projects downstream will also benefit from greater water holding capacity in reservoirs, as low water levels affects potential sluice flows necessary to drive the turbines. Decreased sedimentation will also reduce the need for flushing during early rains to avoid trapping sediments, and thereby avoid the loss of potential hydropower.

Reduced sedimentation in downstream water bodies: Sediment deposits in downstream water bodies such as small lakes and ponds reduce the water holding capacity of these surface water bodies.

Prevention of increases in flood damage: Sedimentation in rivers raises river beds, which can increase the probability of floods (given the same volume of river water flow) and consequently, the damage due to flooding. Similarly, sedimentation can increase flooding potential of downstream water bodies like lakes and ponds.

Increased potential for recreational facilities: Improved water flows in downstream waterways permits the design of river-side recreational facilities like parks and wildlife sanctuaries, which could stimulate local, regional and international tourists.

Preservation of bio-diversity: Augmented water flows in rivers and into downstream water bodies can stimulate habitats for local and migratory birdlife and other wildlife, and could help sustain local biodiversity.[8] Increased vegetation cover in these downstream ecosystems can also result in the return of larger animals which, in turn, could attract recreational and eco-tourists.

Preservation of ecosystem functioning: Ecosystems provide a variety of complex life-support functions services of energy, nutrient and water cycling, maintaining balance between prey and predator populations in the food chain, etc. (see Table 2 below).[9] Along with other interventions, improved water availability and reduced sedimentation could help improve ecosystem functioning, especially in special threatened downstream ecosystems such as lakes and wetlands.

Improved aesthetics: Improvements in water availability in rivers and water bodies along with concomitant improvements in bird, fish and wildlife populations could provide aesthetic benefits to downstream stakeholders. This could also attract local and outside recreational and eco-tourists.

[8] Improved water flows may be a necessary but not a sufficient condition for sustaining biodiversity.
[9] In addition to services, ecosystems also provide goods such as water, food and raw materials.

Table 2: Ecosystem services and functions

Ecosystem services		Ecosystem function	Examples
1	Gas regulation	Regulation of atmospheric chemical composition	CO_2/O_2 balance, O_3 for protection from ultraviolet protection, and SO_x levels
2	Climate regulation	Regulation of global temperature, precipitation, and other biologically mediated climatic processes at global or local levels	Greenhouse gas regulation, DMS production affecting cloud formation
3	Disturbance regulation	Capacitance, damping, and integrity of ecosystem response to environmental fluctuations	Storm protection, flood control, drought recovery, and other aspects of habitat response to environmental variability mainly controlled by vegetation structure
4	Erosion control and sediment retention	Retention of soil within an ecosystem	Prevention of loss of soil by wind, run-off, or other removal processes, storage of silt in lakes and wetlands
5	Soil formation	Soil formation processes	Weathering of rock and the accumulation of organic material
6	Nutrient recycling	Storage, internal cycling, processing and acquisition of nutrients	Nitrogen fixation, N, O and other elemental or nutrient cycles
7	Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess or xenic nutrients and compounds	Waste treatment, pollution control, detoxification
8	Pollination	Movement of floral gametes	Provisioning of pollinators for the reproduction of plant populations
9	Biological control	Trophic-dynamic regulations of populations	Keystone predator control of prey species, reduction of herbivory by top predators
10	Refugia	Habitat for resident and transient populations	Nurseries, habitat for migratory species, regional habitats for locally harvested species, or over-wintering grounds
11	Genetic resources	Sources of unique biological materials and products	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species
12	Recreation	Providing opportunities for recreational activities	Ecotourism, sport fishing, and other outdoor recreational activities
13	Cultural	Providing opportunities for non-commercial uses	Aesthetic, artistic, educational, spiritual and/or scientific values of ecosystems

Source: Constanza et al., 1997, quoted in Perrings (ed.) (2000).

While these watershed interventions should also increase downstream water flows, and thereby increase the potential irrigation and drinking water availability, these will not confer public good benefits, since abstraction by one user group will reduce the amount available for the others.

Global public goods

Preservation of biodiversity: Given the inter-connectedness of biosphere components, preservation of ecosystem functioning and biodiversity in any part of the world is a benefit to the global population. This benefit may be higher if there are special species of flora and fauna in these ecosystems, which are threatened or endangered.

Preservation of option value: The preservation of 'options' for future human development, which may be yet-unknown and contained within ecosystems, is a benefit to the global population, giving them an interest in preserving the ecosystem or watershed in question.[10]

Carbon sequestration: Burning or rotting trees releases sequestered carbon into the environment, increasing the build up of greenhouse gases and the probability of global warming. Reforestation and protection of existing forests, on the other hand, can increase the potential sequestration of carbon. This is therefore a global benefit conferred by enhancing forest cover worldwide, and also through the activities of the proposed watershed management project. Note that deforestation by itself does not lead to the release of sequestered carbon; logging to create wood huts or construction timber maintains levels of sequestered carbon.

4.5 OVERVIEW OF BENEFITS

Table 3 lists potential local, regional and global benefits from the proposed EN-SAP watershed management project.

Table 3: Potential benefits from the EN-SAP watershed management sub-project

	Potential Local Benefits	Potential Regional Benefits	Potential Regional Public Good Benefits	Potential Global Public Good Benefits
1	Increased agricultural productivity and production on rainfed and irrigated land	Improved downstream irrigation potential	Preservation of biodiversity	Preservation of biodiversity
2	Increased production of timber, fuel wood, minor forest produce, grasses	Improved downstream drinking water potential	Increased potential for recreational facilities	Increased potential for recreational facilities
3	Increased livestock production		Improved aesthetics	Improved aesthetics
4	Increased income from alternative livelihood options		Preservation of ecosystem functioning	Preservation of ecosystem functioning
5	Reduced soil erosion damage		Prevention of increases in flood damage	Option value of watershed
6	Reduced expenditure on agricultural chemical inputs		Reduced sedimentation in downstream water bodies	Potential carbon sequestration
7	Reduced sedimentation in local water bodies		Reduced sedimentation of	

[10] Strictly speaking, this is termed 'quasi option value' (Freeman, 2003; Weisbrod, 1964).

	Potential Local Benefits	Potential Regional Benefits	Potential Regional Public Good Benefits	Potential Global Public Good Benefits
			downstream reservoirs	
8	More water in local water bodies		Increased life of downstream reservoirs	
9	Reduced time, effort and costs of collecting water		Increased hydropower generation	
10	Reduced time, effort and costs of collecting fuel wood			
11	Reduced time, effort and costs of collecting fodder			

5. MEASURING PUBLIC GOODS FOR BENEFIT COST ANALYSIS

5.1 INTRODUCTION

The proposed watershed management interventions can generate a variety of local benefits as well as regional and global public goods. While methods to value local benefits are relatively straightforward, the valuation of public goods is more complex. This section details the economic valuation methods available to measure these potential local and public good benefits.

5.2 VALUE OF PUBLIC GOODS

Private goods have market prices, but most environmental goods and services – including certain public goods - do not have a market price, and have therefore to be inferred using special economic valuation techniques. Generally speaking, total value is constructed as:

Total economic value = Use Value + Non-use Value + Option Value

Each of these is further described below**.**

Use values: Public good benefits that contribute to direct use, such as increased carbon sequestration leading to reduced global warming. This is a 'use' value since global warming affects all users. Similarly, increased water availability in the river Nile would have a use value to riparian communities that use it as a source for domestic and irrigation water. Some public good benefits may have direct and indirect use values. A river, for instance, has direct use value for riparian communities and tourists, but also confers 'indirect' use value from recreation and aesthetic beauty.

Non-use values: Some environmental public goods possess value even in the perception of non-users, people who do not directly use the resource in question. The simple knowledge that water availability in the River Nile has increased or that a certain endangered species is now protected and that biodiversity in a special biome has been preserved confers a sense of satisfaction even to people many miles away from these resources. These are all examples of public good benefits that have 'non-use' value.

Option value: Option value is the value obtained from maintaining the option of taking advantage of the use value of a resource at a later date. It is, therefore, like a premium paid for an insurance policy to use the resource later. Quasi-option value is a related concept that derives from the possibility that even though something appears unimportant now, information received later might lead us to re-evaluate it (World Bank, 1998).

5.3 VALUATION METHODS

The total economic value of regional and global public goods can be measured using two alternative approaches: (A) Market based methods and (B) Survey-based methods.

Market based methods: As the name suggests, these techniques use price and other information from markets. The benefit of removing sediments from a reservoir can be measured as the cost of de-silting the reservoir – which can be valued directly from existing prices for hiring a contractor with a dredger. When markets do not exist for the public good in question, a 'proxy' market value may be approximated from a related good. For example, the value of increases in domestic water supply taken from canals by riparian communities may be inferred from the value they would have to otherwise pay to buy from water vendors. Or, the value of fuel wood from homestead or free community supplies may be inferred from the price of commercial energy substitutes (such as cooking gas). Hedonic pricing is another market-based method where the difference between the prices or rents for residential houses enjoying a certain environmental benefit (e.g., a good view of the river) and other houses without access to this environmental benefit, is

used to determine the value of the environmental benefit conferred (e.g., aesthetic value).

Survey based methods: Such methods are used where neither markets nor proxy markets exist for the resource in question. Three major survey type methods are: (1) travel cost methods, (2) contingent ranking methods and (3) contingent evaluation methods.[11] The travel cost method involves conducting a survey to find out how much consumers paid to visit the particular resource (say a Wildlife Park or National Park) and use this value to estimate the 'worth' or value of the public good benefit of the resource in question. Contingent ranking involves giving ranks to different development options, say the conversion of forest land to set up a hydroelectric plant, a wildlife sanctuary or a residential township, and analysing the responses using econometrical analysis to derive the value of the resource in question.

Of the available survey-based methods, the contingent valuation method (CVM)is the most comprehensive of these methods, and consists of providing alternative hypothetical development options, and analysing respondents' stated willingness to pay (WTP) for each of them. The average willingness to pay is estimated using econometric techniques, and this is taken to be the value of the resource in question.[12]

The CVM has been subject to criticism and several methodological challenges were addressed by the quality assurance rules laid down by a panel of eminent environmental economists in the early 1990s that are widely followed today (Arrow et al., 1993). The CVM continues to be the best option for valuing most intangible non-user benefits.[13]

Table 4 below sets out the various economic valuation techniques in the context of valuing ecosystem services, but the data requirements and limitations are applicable to all valuation exercises.

Table 4: Main economic valuation techniques for valuing ecosystem services

Methodology	*Approach*	*Applications*	*Data Needs*	*Limitations*
Revealed preference methods				
Production function (also known as 'change in productivity')	Trace impact of change in ecosystem services on produced goods	Any impact that affects produced goods	Change in service; impact on production; net value of produced goods	Data on change in service and consequent impact on production often lacking
Cost of illness, human capital	Trace impact of change in ecosystem services on morbidity and mortality	Any impact that affects health (e.g. air or water pollution)	Change in service; impact on health (dose-response functions); cost of illness or value of life	Dose-response functions linking environmental conditions to health often lacking; under-estimates, as omits preferences for health; value of life cannot be estimated easily

[11] Other methods include Multi-criteria Analysis, where expert opinions on a range of alternative options is weighted and evaluated. See Jansen (1994).

[12] Freeman (2003) has further details and discussion of survey based methods and revealed preference methods. For detailed discussions of CVM, see Mitchell and Carson (1989) or Bateman et al., (2003).

[13] For a criticism of approaches taken in development countries, see Mitchell and Carson (1995).

Methodology	*Approach*	*Applications*	*Data Needs*	*Limitations*
Replacement cost (and variants, such as relocation cost)	Use cost of replacing the lost good or service	Any loss of goods or services	Extent of loss of goods or services, cost of replacing them	Tends to over-estimate actual value; should be used with caution
Travel cost Method	Derive demand curve from data on actual travel costs	Recreation	Survey to collect monetary and time costs of travel to destination, distance travelled	Limited to recreational benefits; hard to use when trips are to multiple destinations
Hedonic pricing	Extract effect of environmental factors on price of goods that include those factors	Air quality, scenic beauty, cultural benefits	Prices and characteristics of goods	Requires vast quantities of data; very sensitive to specification
Stated preference methods				
Contingent Valuation Method	Ask respondents directly their WTP for a specified service	Any service	Survey that presents scenario and elicits WTP for specified service	Many potential sources of bias in responses; guidelines exist for reliable application
Choice modelling	Ask respondents to choose their preferred option from a set of alternatives with particular attributes	Any service	Survey of respondents	Similar to CV; analysis of the data generated is complex
Other methods				
Benefits transfer	Use results obtained in one context in a different context	Any for which suitable comparison studies are available	Valuation exercises at another, similar site	Can be very inaccurate, as many factors vary even when contexts seem similar.

Source: Quoted in Pagiola (2004), where it is adapted from Pagiola and Platais (forthcoming).

5.4 VALUATION OF PUBLIC GOODS FROM WATERSHED MANAGEMENT

At the outset it must be stated that there are a number of valuation methods, each of which is applicable in specific decision contexts. 'To select the appropriate concept for measurement, it is important to clarify the specific attributes of the situation and decision in question' (Young, 2005). The most appropriate economic valuation techniques for each of the potential public good benefit to be generated from the proposed EN-SAP watershed management project are briefly described below.

Regional public goods

Reduced sedimentation in downstream reservoirs: *Method:* Incremental cost of dredging sediment in each downstream reservoir.

- Method used to estimate downstream costs of soil erosion in the Loess Plateau in China (Magrath, 1994)

Calculate the estimated reduction in sedimentation in each downstream reservoir from the watershed in question, due to the interventions proposed. Value this quantity of sediment using the unit cost of dredging each reservoir (calculated by dividing the total cost of dredging by the amount of sediment removed). The dredging cost saved or avoided in each case is the measure of the value of the public good benefit from watershed management. The project aimed to reduce sediment transfer to the Yellow River by about 41 million tons annually, and since the cost of dredging was RMB Yuan 0.07 per ton, the value of the sediment retained in the Loess plateau, due to the project was estimated as yuan 0.07 x 41 million tons = yuan 2.84 million. Around 1.2 billion tons of sediment was estimated to be retained over the 30-year life of the project.

Increased life of reservoirs: *Method:* This benefit is already captured in the calculation of dredging costs avoided (given above). Adding it again would be double-counting.

Improved hydro-electric power generation: *Method*: Incremental cost of sourcing electricity from other sources.

Calculate the amount of water required to generate a unit of additional electricity, and the amount of potential additional water flow into the reservoir with the hydro-power generating facility, as a direct result of watershed interventions upstream. Value the additional electricity potential by the value of a commercially generated unit of electricity. Where supply is to a range of industrial, domestic and institutional consumers, use a weighted average price derived using the proportion of each class of consumer to weight the different supply prices. If supply prices are distorted by subsidies, shadow prices are to be used to generate corrected values.

Prevention of increases in flood damage: *Method*: The incremental cost avoided of downstream flood damage from rivers or hedonic price estimates of housing price variations.

- Method used in the World Bank-supported Vietnam Ho Chi Minh Environmental Sanitation Project, and the Yangtze Dike Strengthening Projects (Silva and Pagiola, 2003).

Loss probability curves for baseline and projected project-end scenarios, estimate the difference in probability and the severity of floods occurring under the two scenarios. The avoided costs of such damages are the main source of benefits, and were calculated from surveys done to assess the damage of previous floods.

- Method used in the World Bank-supported Belize Roads and Municipal Drainage Project (Silva and Pagiola, 2003).

Where households are raising plot levels to avoid flooding, calculate the difference between property prices in well drained areas less prone to flooding damage, and those in poorly drained flood-prone areas. With perceived reduced risk of flooding, the property values in the latter should also begin to rise. This incremental value is the benefit of flood control as a result of watershed management project upstream. This presumes, however, that reduced flooding is only on account of project interventions. The discussion in the analysis notes that well-drained areas property areas were 20 to 100% higher than in poorly drained areas, and that an 18% increase in property values would be sufficient to justify the drainage component of the project.

The value of the next four benefits may be calculated using a regional contingent valuation survey to estimate the willingness to pay for improved river management.

Increased potential for recreational facilities
Preservation of bio-diversity
Improved aesthetics
Preservation of ecosystem functioning

These are all non-user values derived by people living in the region and tourists to the region. The contingent valuation survey could depict different scenarios with and without watershed management (or with different levels of watershed management), listing all the regional public goods mentioned above as potential benefits for the hypothetical scenario with watershed management.[14] The sample of respondents could also include tourists in the region, as was done in the contingent valuation survey of the Ganga Action Plan (Markandya and Murty, 2000).

As Colombo et al. (2003) note, among the survey-based valuation methods only the contingent valuation method has been applied to the economic analysis of off-site effects of soil erosion. But no empirical work has accounted for the total economic value of the external effects of soil erosion – till their study in southern Spain. The present CV proposed here, therefore, would break new methodological ground and would also be the first on this subject in Africa. Although several CVs have been done in Africa, most have tended to be location-and context-specific and hence difficult to extrapolate.[15]

Due care must however be taken in designing the CVM questionnaire, hypothetical scenarios and bidding formats, as values are sensitive to what exactly is being asked (Mitchell and Carson, 1989).

Global public goods

Carbon sequestration: *Method:* Incremental global damage costs avoided due to additional carbon sequestration.

- Method used in the World Bank supported Armenia Natural Resource Management and the Tanzania Forest Conservation and Management Projects

Calculate additional carbon sequestered through biomass additions in the watershed project area (e.g., Brown et al., 1989; Ponce et al., 2002). Value each unit of additional carbon sequestered. Use the estimates of climate change impacts and resulting damages available in the literature (see Watson et al., 1996). Carbon sequestration is the most valued type of global environmental (or public good-type) benefit. Some projects value these benefits and add them to the BCA, while others value them but do not include them in the analysis.[16] The two projects mentioned above calculated damage values in the range of US$ 5 – 20 per ton equivalent of CO_2 emissions (Silva and Pagiola, 2003).

- Method used in the World Bank-supported Poland Geothermal Project, the Liepaja Solid Waste Management Project and the Papua Guinea Forestry Conservation Projects.

[14] This could even be a general CV survey for all the regional public goods likely to be generated through the implementation of the full range of IDEN projects being considered. In this case, however, the benefits will not be attributable only to the watershed management sub-project. While this may be desirable given the difficulty of 'nested' benefits (i.e., people confusing their WTP for one sub-project with that of *all* sub-projects), this affects the benefit cost analysis of watershed management sub-project alone.

[15] Perrings (ed.) (2000) details several innovative methods used to value the benefits of biodiversity conservation in sub-Saharan Africa (Malawi, Kenya, Namibia and Ghana), but these not only require substantial data collection and complicated economic modelling, but also focus on the impacts of specific proposed development or conservation activities (e.g., the loss of flood plain benefits due to a proposed dam, loss of aquatic biodiversity due to pollution and over-fishing, the direct and indirect benefits of an existing forest reserve, the impact of structural adjustment policies on deforestation & biodiversity, etc.). Benefit transfer, as discussed in Table 4, is not recommended.

[16] The consequences of not including environmental benefits are discussed in Section 5.8 below.

Use the WTP of international donors (either directly or through the GEF) as the lower bound measure of value of the environmental benefits generated. Actual payments made under the still-new carbon emissions market have tended to be low and the Prototype Carbon Fund (PCF, 2002), for instance, pays USD 3 – 4 per ton equivalent of CO_2 emissions (Silva and Pagiola, 2003).

The same valuation issues apply to the last two global public good benefits.

Preservation of biodiversity
Preservation of option value

Method: Use the WTP of international donors (either directly or through the GEF) as the lower bound measure of value of the environmental benefits generated. Since using this method with direct valuation of incremental carbon sequestration benefits (see above) would constitute double counting, it would be best if only this value was used to value for all global public goods arising from the proposed Watershed Management Project.

5.5 OVERVIEW OF METHODS

Table 5 summarises suggested methods to value the potential regional and global public good benefits from the proposed EN-SAP Watershed Management Project.

Table 5: Suggested Economic Valuation Methods for Regional and Global Public Goods from the EN-SAP Watershed Management Project

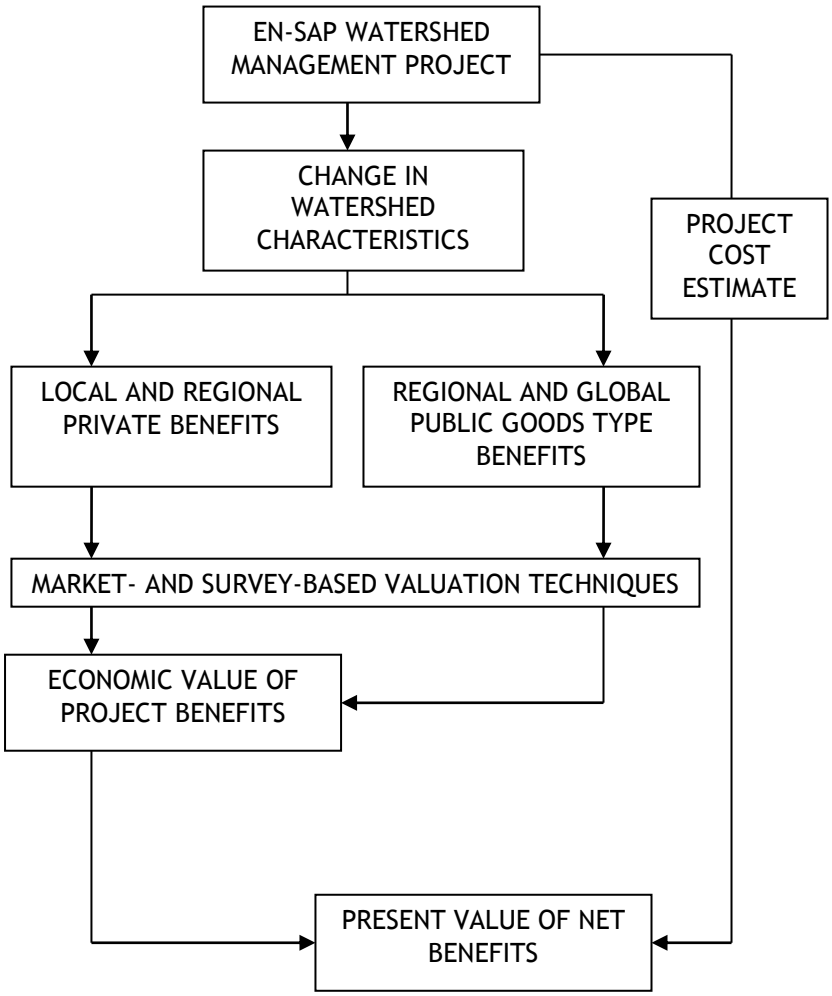
Public Good Benefit	Suggested Economic Valuation Method
Regional Use Benefits	
Reduced sedimentation of downstream reservoirs	Incremental cost of dredging sediment in each downstream reservoir
Increased life of downstream reservoirs	
Increased hydropower generation	Incremental cost of sourcing electricity from other sources
Prevention of increases in flood damage	Incremental cost avoided of flooding damages in downstream rivers OR Hedonic price estimates of housing price variations
Regional Non-use Benefits	
Increased potential for recreational facilities	Contingent valuation survey of non-user benefits for improved river management. The same survey could also sample downstream users to calculate WTP for benefits for regional use benefits
Preservation of biodiversity	
Improved aesthetics	
Preservation of ecosystem functioning	
Global Use Benefits	
Increased carbon sequestration	Incremental global damage costs avoided due to additional carbon sequestration valued using damage cost estimates in the literature OR Use the donor contributions to the sector as a lower bound
Global Non-use Benefits	
Quasi option value of watershed	Use the donor contributions to the sector. Since this also values increased carbon sequestration (see above), donor contribution estimates could be used for all global use benefits
Preservation of biodiversity	

5.6 BENEFIT COST ANALYSIS

General Method: A Benefit Cost Analysis involves the aggregation of the present value of the time-streams of all benefits and costs expected generated by the proposed project. The introduction of social and environmental concerns generates an Environmental Benefit Cost Analysis or Assessment (EBCA). The three steps involved in the context of the EN-SAP Watershed Management Project are the following (Figure 3):

1. Calculate costs of the (watershed management) project
2. Calculate all possible monetary benefits of the (watershed management) project
3. Calculate present value of net benefits from the (watershed management) project.

Figure 3: Social Benefit Cost Analysis Model for EN-SAP Watershed Management Sub-Project



Source: Adapted from McDonald and Johns (1999)

Net Present Value: If the watershed programme is to be implemented over 5 years, the time-stream of total costs may be depicted as C_1, C_2, C_3, C_4 and C_5. If the time-stream of total benefits from all watershed interventions is expected to last 20 years may be depicted as B_1, B_2, …, B_{20}. The stream of net benefits in each year is (B_1-C_1), (B_2-C_2), … , $(B_{20} - C_{20})$, where all values of C_t are 0 after C_5. The present value (NPV) of is the sum of discounted net benefits, where the discounted net benefit for any year *t* is obtained by

dividing each net benefit value (e.g., B_2-C_2) by $(1+r)^t$ where r is the social 'discount' rate.[17]

$$\text{NPV} = \sum_t (Bt - Ct) / (1+r)^t$$

Table 6 below shows the Benefit Cost Analysis for the general case of EN-SAP watershed management range of costs and benefits.

Table 6: General case of benefit cost analysis for the EN-SAP Watershed Management Sub-Project

	Project Year 1	Project Year 2	Project Year 3	Project Year 4	Project Year 5	Project Year 6	…	Project Y20
Total Project Costs	C_1	C_2	C_3	C_4	C_5	0	0	0
Local & Regional Benefits	LRB_1	LRB_2	LRB_3	LRB_4	LRB_5	LRB_6	…	LRB_{20}
Regional Public Good Benefits	RPB_1	RPB_2	RPB_3	RPB_4	RPB_5	RPB_6	…	RPB_{20}
Global Public Good Benefits	GPB_1	GPB_2	GPB_3	GPB_4	GPB_5	GPB_6	…	GPB_{20}
Total Project Benefits	$B_1 = LRB_1+RPB_1+GPB_1$	B_2	B_3	B_4	B_5	B_6	…	B_{20}
Net Benefits	(B_1-C_1)	(B_2-C_2)	(B_3-C_3)	(B_4-C_4)	(B_5-C_5)	B_6	…	B_{20}
Discounted Net Benefits (discount rate 10%)	$(B_1-C_1)/(1.10)$	$(B_2-C_2)/(1.10)^2$	$(B_3-C_3)/(1.10)^3$	$(B_4-C_4)/(1.10)^4$	$(B_5-C_5)/(1.10)^5$	$(B_6-C_6)/(1.10)^6$		$(B_{20})/(1.10)^{20}$

Present value calculations of net benefits with the project and without the project reveal the incremental benefit of the proposed project over the baseline (without project) situation. The decision making rule is if that the incremental benefit of the proposed project exceeds the costs – i.e., the NPV > 0 and is not negative - go ahead with the project. The rate of discount that equates the NPV of benefits with NPV of costs is called the internal rate of return (IRR). An IRR of more than the social rate of discount (usually 10-12%) normally signifies an economically viable project – though it is better to use the NPV as the decision-making rule (Belli, 1996).

Two good practices are generally followed. The first is to clearly state all assumptions made in the EBCA. Assumptions are inevitable, and underlie almost every number that

[17] There is a huge literature on what the appropriate rate of social discount should be for environmental projects, with little resolution. The World Bank recommends that 10% be used as the standard opportunity cost of capital, arguing that a lower discount rate would cause more projects to pass the cost-benefit test and cause additional environmental stress. The UK Treasury recommends 6% as the real discount rate for most purposes in the UK (Abelson, 1996). For some more discussion on the social discount rate, see Annexure 3.

goes into the benefit stream calculations. Different assumptions (say on the number of years before trees will begin to sequester atmospheric carbon) will lead to different estimates. The second is to check the robustness of results by calculating 'switching values' and doing sensitivity analyses to test the impact of changing (1) the discount rate (2) the physical quantities and qualities of inputs and outputs and (3) input and output prices assumed (4) the nature of benefits (e.g., public good benefits) (5) the expected time period of benefits (including delays in project implementation and completion) and (6) the life span of the project. Sensitivity analysis helps test how the IRR responds to different situations.

Sensitivity Analysis: The Project Appraisal Document (PAD) of the World-Bank supported Karnataka Watershed Development Program in India (World Bank, 2001) quotes supporting working papers detailing the methods used to arrive at all the various benefit estimates used in the benefit-cost analysis that yields an NPV of USD 173 million and an Economic IRR (EIRR)[18] of 16.4% on an investment of USD 100 million spread over a 5-year period (2002 – 2007) (Box 1).

Box 1: The World Bank-supported Karnataka Watershed Development Project, India

The impact of project conservation activities are expected to increase in-situ soil moisture, reduce soil erosion and nutrient loss and increase groundwater tables. Yields of rainfed crops are expected to rise by 10% and of irrigated crops by 15%, as a result of a package of measures including improved cropping systems, appropriate tillage, the use of improved seed varieties and more balanced use of chemical fertilizers and pesticides (Silva and Pagiola, 2003 and World Bank, 2001).

It reports the results of a sensitivity analysis to see what happens to the EIRR if project benefits are lagged or advanced by one year. If lagged by a year, the EIRR falls to 15%, and if benefits arrive a year earlier than assumed, the EIRR rises to about 19%.[19]

An illustration of the role of sensitivity analysis for the proposed EN-SAP watershed management project is detailed in Table 7. The total investment cost of the project has been assumed to be USD10 million, while values of the time-streams of recurrent costs, local & regional benefits as well as public good benefits have also been assumed, purely for the purposes of illustration. The total EIRR for all benefits is 14.56%, which falls to 13.39% without regional public good benefits, 10.93% without global public good benefits, and 9.53% without any public good benefits.[20] Alternatively, lagging benefits by 1 year reduces the EIRR for all potential project benefits from 14.56% to 12.46%. Further sensitivity analysis can also be carried out on similar lines. For instance, reducing the social discount rate to 10% doubles the NPV of net benefits from USD 1.64 to 3.44 million.

[18] An EIRR values inputs and outputs at their opportunity costs; a financial IRR (FIRR) on the other hand uses financial costs (which may not reflect the opportunity cost of inputs and outputs due to market distortions (e.g., monopoly, monopsony) and policy distortions (e.g., subsidies).
[19] Cost Benefit Analysis Summary, Annex 4, World Bank (2001).
[20] After listing estimated costs and benefits, the IRR (rate, value1, …., value 20) function in an EXCEL spreadsheet returns the IRR for any chosen discount rate and range of values. Similarly the NPV(rate, value1,…, value 20) function returns the NPV.

Table 7: Illustration of sensitivity analysis for the proposed EN-SAP Watershed Management Sub-Project

Project Year	ACTUAL ANNUAL COSTS		ACTUAL ANNUAL BENEFITS				SENSITIVITY ANALYSIS (IMPACT ON NPV AND EIRR)				
	Capital Costs	Recurring Costs	Local Benefits	Regional Benefits	Regional Public Goods	Global Public Goods	All Benefits	Without Regional Public Goods	Without Global Public Goods	Without Any Public Goods	Benefits Lagged by 1 year
1	-1,760,000	-44,000	0	0	0	0	-1,804,000	-1,804,000	-1,804,000	-1,804,000	-1,804,000
2	-2,112,000	-88,000	-61,766	0	0	0	-2,261,766	-2,261,766	-2,261,766	-2,261,766	-2,200,000
3	-3,041,280	-105,600	-192,800	0	0	0	-3,339,680	-3,339,680	-3,339,680	-3,339,680	-2,701,766
4	-2,534,400	-126,720	57,540	154,120	225,130	0	-2,224,330	-2,449,460	-2,224,330	-2,449,460	-3,360,800
5	-552,320	-126,720	283,024	317,490	54,617	0	-23,909	-78,526	-23,909	-78,526	-242,250
6	0	-126,720	647,077	718,290	72,823	450,187	1,761,657	1,688,834	1,311,470	1,238,647	528,411
7	0	-126,720	679,431	739,839	91,028	472,696	1,856,274	1,765,246	1,383,578	1,292,550	1,761,657
8	0	-126,720	713,402	762,034	109,234	496,331	1,954,281	1,845,047	1,457,950	1,348,716	1,856,274
9	0	-126,720	749,072	784,895	130,402	521,148	2,058,797	1,928,395	1,537,649	1,407,247	1,954,281
10	0	-126,720	786,526	808,442	148,608	547,205	2,164,061	2,015,453	1,616,855	1,468,247	2,058,797
11	0	-126,720	825,852	832,695	166,814	574,565	2,273,206	2,106,392	1,698,641	1,531,827	2,164,061
12	0	-126,720	867,145	857,676	176,823	603,294	2,378,217	2,201,394	1,774,923	1,598,100	2,273,206
13	0	-126,720	910,502	883,406	187,432	633,458	2,488,078	2,300,646	1,854,620	1,667,188	2,378,217
14	0	-126,720	956,027	909,908	198,678	665,131	2,603,025	2,404,346	1,937,893	1,739,215	2,488,078
15	0	-126,720	1,003,828	937,206	210,599	698,388	2,723,300	2,512,702	2,024,913	1,814,314	2,603,025
16	0	-126,720	1,054,020	965,322	223,235	733,307	2,849,163	2,625,929	2,115,856	1,892,621	2,723,300
17	0	-126,720	1,106,721	994,281	236,629	769,973	2,980,883	2,744,255	2,210,911	1,974,282	2,849,163
18	0	-126,720	1,162,057	1,024,110	250,827	808,471	3,118,744	2,867,918	2,310,273	2,059,446	2,980,883
19	0	-126,720	1,220,160	1,054,833	265,876	848,895	3,263,044	2,997,167	2,414,149	2,148,273	3,118,744
20	0	-126,720	1,281,167	1,086,478	281,829	891,339	3,414,094	3,132,265	2,522,754	2,240,926	3,263,044
Total	-10,000,000	-2,391,840	14,048,983	13,831,024	3,030,583	9,714,389	28,233,139	25,202,556	18,518,750	15,488,167	24,692,325
NPV (@12%)	**-7,343,883**	**-826,771**	**3,263,742**	**3,517,725**	**770,133**	**2,263,226**	**1,644,172**	**874,039**	**-619,054**	**-1,389,186**	**303,503**
Economic Internal Rates of Return							14.56%	13.39%	10.93%	9.53%	12.46%

5.7 ROBUSTNESS OF BENEFIT COST ANALYSIS

There are at least three instances where NPV may not be accurate as a criterion to evaluate project viability, and two approaches to checking the results of BCA.

Switching values and sensitivity analysis

The switching value of an expected benefit is the percentage change required in the value of a variable (cost or benefit) to turn the NPV equal to zero, and is useful in identifying which variables most affect project outcomes (Table 8).

Table 8: Illustrative switching values

	Variable	Switching value
1	Yield per hectare	-25%
2	Construction Costs	40%
3	Irrigated area per pump	-50%
4	Shadow exchange rate	60%

Source: Belli (1996)

These figures imply that it would take only a 25% shortfall in expected yields will cause the NPV to turn negative, other factors remaining as expected. Similarly if construction costs rise by 40%, the project NPV will turn negative. The former is more likely than the latter and hence project implementation ought to concentrate more on ensuring that projected benefits are realized.

Going beyond sensitivity analysis

The World Bank's preferred approach to sensitivity analysis is 'switching values'. However, the Bank's Handbook on Economic Analysis of Investment Operations (Belli, 1996), is aware that sensitivity analysis has three major shortcomings: (1) it does not take into account the probability of the change occurring (e.g., delays in projects, increases in cost components, etc.); (2) it does not take into account relationships between the variables being changed (e.g., yield per hectare and irrigated area per pump); and (3) changing the values of the variables by standard percentages may not be how the change is likely to happen in reality (Belli, 1996, p. 90).

Risk analysis

In three exceptional cases a project cannot be accepted or rejected solely on the basis of the NPV, and will require an evaluation of how 'risky' it is: If (1) the project is so large relative to the economy that a loss have a significant impact on national income (in which case it may be better to opt for a smaller, but less risky option); (2) the project depends on factors that can fluctuate widely, e.g., rainfall, in which case it may be better to opt for a project that yields better in times of low rainfall); and (3) the project expects to have a large effect on a particular region or groups or people (in which case the option that poses lower risks to poor and vulnerable sections of the population should be chosen)(Belli, 1996). In such cases, the NPVs can be adjusted for risk. However, actual adjustments for risk may be only 'fractions of one percent' for most projects, and not really worth doing. Doing a risk analysis, however, helps improve project design and is useful in convincing 'risk averse' donors that risks have been factored into the analysis.

5.8 ENVIRONMENTAL BENEFIT COST ANALYSIS

The Implementation Completion Report (ICR) of the World Bank-supported Loess Plateau Watershed Rehabilitation Project in China, implemented from 1994 to 2000 (Box 2), calculates EIRR for each type of watershed intervention, e.g., terracing, dam construction, irrigation, Afforestation and livestock.

Box 2: World Bank-supported Loess Plateau Watershed Rehabilitation Project in China

The primary objective of this USD 150 million watershed rehabilitation project was to increase agricultural production and incomes on 1.5 million hectares of land in the Loess Plateau in nine tributary watersheds of the Yellow River, while the secondary objective was to reduce sediment inflows into the Yellow River. The main components of the project were terracing (90,500 ha), forestation (90,900 ha), planting shrubs (136,000) ha, economically useful tree species (26,700), orchards (30,890 ha), and grasslands (100,140 ha), providing irrigation (7,100 ha) and constructing sediment control dams (3,245 of different types) besides institutional support. A grazing ban was not part of the project components, but was enforced successfully by the Chinese authorities – which added to be project benefits of reduced soil erosion (Shaojun et al., 2004).

As it was primarily designed to improve agricultural productivity and reduce soil erosion in the region, the sedimentation-reduction aspect was not included in the original BCA of the project. Subsequent addition of benefits from reduced sediment transfer to the Yellow River raised the NPV and increased the IRR from 19% to 22% (Magrath, 1994). Table 9 details the results of the sensitivity analysis for the Loess Plateau project when sediment reduction impacts and/or global carbon sequestration benefits are not considered.

Table 9: EIRR Sensitivity to Project Benefits, Loess-Plateau Watershed Rehabilitation Project

Project component	Economic Internal Rates of Return (%)		
	Without sediment reduction and global benefits	With sediment reduction benefits	With sediment reduction and carbon sequestration benefits
Terracing	23	26	26
Dam construction	5	26	26
Irrigation	32	32	32
Afforestation	10	13	17
Orchards	25	26	26
Economic Trees	22	22	22
Livestock	33	36	36
Total Project	19	22*	29*

*includes benefits from a grazing ban, not part of individual project components.

Source: Shaojun et al, (2004), p. 22

A recent World Bank review of the valuation of environmental costs and benefits in a wide range of World Bank Projects (World Bank, 2003) clearly brings out the implications on both NPV of net benefits and the EIRR. When environmental benefits were included to estimated project returns on investment, the NPV rose from 40 to 150% times the original estimates while the EIRRs increased by 2 – 8 percentage points (see Table 10).

Table 10: Effect of including environmental benefits on estimated project returns

Project		Percentage change in NPV	Percentage point change in EIRR	Comments
1	China Hubei Hydropower	49	1.9	Additional global environmental benefits of US$ 13.6 million not included in the original NPV and IRR of the project.
2	Cartagena Water supply	41		EIRR with environmental benefits is 16%
3	Teheran Sewage	153	8	Higher benefit estimates based on willingness-to-pay for sanitation and avoided costs. Lower benefit estimates based only on avoided costs
4	Azerbaijan Irrigation		6	Water supply benefits important in sensitivity analysis
5	Armenia Natural Resource Management	130	4	Environmental benefits include both local and global environmental benefits

Source: Adapted from Silva and Pagiola (2003), p. 20.

Such findings strengthen the case for including economic values of environmental benefits of projects, including the regional and public good type benefits expected in the case of the EN-SAP watershed management sub-project, and thus to carry out an environmental benefit cost analysis of the project.[21] However, benefit cost analysis requires care to ensure its findings are robust.

[21] Benefit cost analysis is considerably more complex than what has been depicted here for the sake of simplicity and ease of access for non-economists. There are several excellent guides to BCA for project appraisals, including Belli (1996), while practical examples are provided in Abelson (1996), Perrings (2000) etc.

6. DISTRIBUTIONAL ISSUES

6.1 INTRODUCTION

Since costs and benefits of watershed programmes can vary across different stakeholders, it is important to value benefits accruing to poor stakeholders appropriately to reflect social equity considerations. This section discusses distributional weights that can be attached to the stream of local use benefits, under the assumption that all local project beneficiaries are likely to be poor and benefit from poverty alleviation and alternative income generation possibilities from the proposed project interventions. An example from the cost-benefit analysis of the Ganga river clean-up programme in India is used as an example to demonstrate the use of income distributional weights for the benefit stream. This procedure can be generalized for different countries and regions of the basin.

6.2 INCOME DISTRIBUTION WEIGHTS

If all local project stakeholders are assumed to be rural and so poor, local use benefits need to be adjusted to reflect this fact. Income distribution weights are usually defined that increase the value of benefits accruing to poor stakeholders and decrease the value of benefits going to relatively better-off stakeholders.

Atkinson (1970) defined a procedure to estimate income distribution weights attributable to incomes of poor individuals.[22] He assumes a social welfare function of the following form:

$$W = \sum_{i=1}^{N} \frac{AY_i^{1-\varepsilon}}{1-\varepsilon}$$

where

W= social welfare function
Y_i = income of individual i
ϵ = elasticity of social marginal utility of income or inequality aversion parameter[23]
A = a constant

The social marginal utility of income (SMU_i) is the value attached to a single $ going to a person with income i relative to the value of a $ going to a person with the average per capita income in say Sudan. Assuming per capita national income (Y bar) is the numeraire, and giving it a value of 1, the SMU_i become the income distributional weights to be attached to benefits going to group i relative to benefits to the person with income equal to the national per capita income. SMU_i can be defined as follows:

$$SMU_i = \left[\frac{\bar{Y}}{Y_i}\right]^{\varepsilon}$$

With estimates of Y bar (average per capita national income) and ϵ the weights can be devised and applied.

[22] This section is based on Markandya and Murty (2000), Chapter 12.
[23] For more discussion on the social marginal utility of income, see Annexure 3.

6.3 SOCIAL VALUE OF AVERAGE INCOMES

If estimates of Є have been calculated for the country, they may be used. If not, they can be approximated from existing estimates from a similar country (estimates for India and some other countries, for instance vary from 1.0 to 2.0). If a baseline household survey with average annual income of the different stakeholder groups in the proposed project is available, the distributional weights can be devised for each category.

In 2003, Sudan has a national per capita income of $ 460. Table 11 gives the distributional weight to be attached for 8 different income classes on either side of this average value.

Table 11: Illustrative Income distribution weights

Average income of income class	Values of the Inequality Aversion Parameter Є		
	Є = 1	Є = 1.75	Є = 2
300	1.533	2.113	2.351
350	1.314	1.613	1.727
400	1.150	1.277	1.323
460	**1.000**	**1.000**	**1.000**
500	0.920	0.864	0.846
550	0.836	0.731	0.700
600	0.767	0.628	0.588
650	0.708	0.546	0.501

Suppose data from the project revealed that two groups (1) smallholder farmers and (2) herdsmen and average per capita incomes of Rs. 300 and Rs. 400 respectively. Table 11 shows that the income distributional weights for smallholder farmers would be 1.533 for an income inequality aversion parameter (Є) value of 1, and 2.351 for a Є value of 2. Similar figures for herdsmen are 1.150 for a Є value of 1 and 1.323 for a Є value of 2.

For a specific value of Є as 2, one $ of income accruing to smallholder farmers would have a social value of 2.351, while one $ accruing to herdsmen had a social value of 1.323. Note that for all average income classes above the national average, weights are less than 1, indicating that the social value of a $ given to someone from those classes is less than 1$.

6.4 APPLYING INCOME DISTRIBUTIONAL WEIGHTS

Assume average income for four different local and regional stakeholder groups are as given in the first column of Table 11. The income distributional weights for various stakeholder groups for 3 different values of Є are given in Table 12 below.

Table 12: Calculating Є for different stakeholder groups

	Annual per capita income ($)	Є = 1	Є = 1.75	Є = 2
Local benefits: Smallholders	300	1.533	2.113	2.351
Local benefits: Herdsmen	400	1.150	1.277	1.323
Regional benefits: Urban Users	650	0.708	0.546	0.501
Regional benefits: Rural Users	500	0.920	0.864	0.846
Government	460	1.000	1.000	1.000

Assume the cost of the project is 250 million USD. If the NPV estimates from the benefit cost analysis are assumed to be as in the first column of Table 12, this is the case when Є is 0 – i.e., no adjustment has been made on distributional grounds. Note that the cost of the project is assumed to be borne by the government. In this case the NPV is 30 million USD. When the weights derived in Table 12 are applied to these benefits, the value of benefits to poorer stakeholder groups goes up while that to relatively better off groups decreases (Table 13: last 3 columns).

Table 13: Calculating Є for different stakeholder groups

All figures in million US$

	Є = 0	Є = 1	Є = 1.75	Є = 2
Local benefits: Smallholders	70	107	148	165
Local benefits: Herdsmen	60	69	77	79
Regional Urban users	30	21	16	15
Regional users	120	110	104	102
Government	-250	-250	-250	-250
Net Present Value (NPV)	30	58	95	111

6.5 OVERVIEW OF DISTRIBUTIONAL IMPACTS

If the majority of beneficiary stakeholders in the project are poor, the Net Present Value from the Social Benefit Cost Analysis can be adjusted to reflect this distributional aspect of project implementation.

7. IMPACTS ON PROPOSED EN-SAP PROJECTS

7.1 INTRODUCTION

Although the ENSAP watershed management project is to be the first sub-project on the ground, it is part of another six sub-projects under the Integrated Development of Eastern Nile (IDEN) project. While the later projects would benefit from the upland watershed management work already done under this sub-project, the other projects would also enhance the benefits of watershed management, especially downstream. The vision of integrated water resource management, however, will require substantial resources and institutional change.

7.2 POTENTIAL IMPACT ON PROPOSED EN-SAP PROJECTS

Proposed EN-SAP Projects

The six EN-SAP sub-projects in addition to watershed development sub-project are the following:

- *Integrated Water Resources Management*
    1. Baro-Akobo Multipurpose Water Resources Development Sub-Project
    2. Eastern Nile Planning Model Sub-Project
- *Flood and Drought Management*
    3. Flood Preparedness and Early Warning Sub-Project
- *Hydropower Development and Regional Power Trade*
    4. Ethiopia-Sudan Transmission Interconnection Sub-Project
    5. Eastern Nile Power Trade Investment Program
- *Irrigation & Drainage Development*
    6. Irrigation and Drainage Sub-Project
- *Watershed Management*
    7. Watershed Management Sub-Project

Flood and drought management: Flooding is not likely to be largely affected by the watershed management project, although it could decrease the rate at which river beds are rising. De-silting of the river beds and creating protective structures to contain flood waters are likely to have a far greater impact on reducing the damage from flooding. Even early warning systems, as in the case of the recent tsunami tragedy, require well-coordinated evacuation plans that enable communities to move away in time and not suffer as a consequence of the move itself (as is happening in many tsunami relief camps in south India, and more recently, in the earthquake relief camps in Pakistan and India). Drought management, similarly, calls for a coordinated response from government agencies. Lessons from a spate of droughts in recent years in India show, in particular, responses need to be self-triggering, instead of waiting on authorization from higher authorities to initiate any action on the ground.

Hydropower development: The proposed multi-purpose and hydro-electric plants will definitely benefit from lower sediment transport and accumulation in rivers, as a result of upland treatment. The point to note, however, is the extent to which the focus of the watershed management sub-project addresses the *overall* problem of sediment transport and deposit. Thus, if the hydropower plant is located at points on the river where the impacts of the upstream watershed management are felt strongly, the benefit will be palpable. In some parts of the north-Indian state of Himachal Pradesh, for instance, hydro-electric plants have to open their sluice gates during monsoon rains because of the high

silt load in the water due to a lack of upland watershed treatment. Worse, this silt accumulates on downstream farmers fields in excess of what is beneficial for the soil. The cost to poor farmers is that they have to forgo cultivation because there is too much of water.

Irrigation and drainage: This is a high impact sub-project given the large irrigation potential in most of the river basins in the EN-SAP region. Irrigation canal systems, however, are notorious for causing problems of water-logging and salinity in areas neighbouring the canals (e.g., in Punjab and parts of north Rajasthan), either due to faulty drainage or groundwater conditions. Groundwater extraction through bore wells in areas adjacent to canals has been found to help reduce water logging. Upstream watershed management ought to increase water availability – but whether or not it does so everywhere, and by how much, will depend on a variety of local factors, including the nature of tree and shrub species in the local forests.[24]

7.3 PROSPECTS FOR INTEGRATED WATER RESOURCE MANAGEMENT

EN-SAP envisages a multipurpose projects that may include the bundling of multi sectoral projects across Eastern Nile river systems and national borders, e.g. upland watershed management combined with a hypothetical future scenario of cascading systems of reservoirs across countries to generate hydropower, provide storage for flood and drought management, regulate flows for downstream uses, such as irrigation and water supply, and provide for continued sustainable wetlands and ecosystems functions (TOR).

Although such an integrated framework is definitely possible, and the framework of Integrated Water Resource Management (IWRM) (GWP, 2000) is a conceptually sound framework within which to locate the IDEN set of sub-projects, some doubts have been raised in the south Asian context. Moench et al. (2003) for instance find that 'attempts to comprehensively 'integrate' relevant factors into water management approaches and decision-making are unlikely to be successful in most situations found in South Asia.' (p. 8).

Shah (2005) argues that it is not the size and extent of a country's water resource endowment that makes good IWRM possible, but (1) its stage of economic and institutional development (as in the case of Europe and Australia), and (2) the extent of coercive power that the state can muster (quoting the cases of Oman and Tanzania). He however points out that even the latter has limits, as in the case of authoritarian China. Shah points out that a large number of users in direct contact with water resources, and the nature of changes required in water institutions, infrastructure and administration, especially in developing countries, are serious deterrents to adopting IWRM in practice.

This does not imply that the IDEN project may not achieve its objective, but suggests that care needs to be taken – backed up by good-quality analysis – to ensure that the projected benefits are realised on the ground.

[24] There is a large literature debating the largely unresolved issue of whether forests enhance or decrease water flows in the watershed. The approach now is to go case-by-case rather than generalize from one area (country) to another.

8. FINANCING OPTIONS FOR THE PROPOSED EN-SAP PROJECTS

8.1 FIVE POSSIBILITIES

A benefit cost analysis that is able to show a high NPV of net benefits from project interventions, including regional and global public good benefits, will provide a strong justification for the proposed watershed management sub-project in Sudan and Ethiopia. Given the calculated costs and benefits, there are at least 5 financing possibilities:

1. **Citizens pay:** Extra taxation or special collections within the two countries can raise finances to pay national contributions to finance the sub-project. The contributions can be in proportion to either expected national project costs or national project benefits, and could be based on a contingent valuation study of willingness to pay for improved river management. But since willingness to pay is based on 'ability to pay', raising the entire corpus required through such means may not be economically feasible, given that these are both relatively impoverished developing countries with a history of internal conflicts (some of which are still on-going).
2. **National governments pay:** Another alternative is for national governments to divert existing development expenditure to the areas being targeted by the proposed watershed management sub-project, and use these funds to pay project costs. This however will require not just a critical analysis of available funds, but also political consensus on the implied priority of the sub-project vis-à-vis other developmental activities.
3. **Beneficiaries pay:** Project beneficiaries in each country could contribute according to proportion of benefits received. Even if all costs may not be covered, some part of the potential incremental prosperity could be captured through well-designed incentive schemes. The standard practice in India is that investments on public land involve community contribution in cash, material or labour of around 10% of local intervention costs, while watershed interventions on private land require contributions of up to 50% of local capital expenses (e.g., World Bank, 2001). Further, beneficiaries are expected to contribute 100% of subsequent operation and maintenance costs (including protection of plantations, maintenance of check dams and other drainage line structures). Loess Plateau project in China, for instance, recovered around 60% of project costs from beneficiaries, which not only provided incentives to maintain and develop the land, but also reduced the burden on public funds.
4. **National governments borrow**: A fourth possibility is for these two national governments (or an agency like the NBI on their behalf) to take a loan from international financial organizations such as the World Bank, International Monetary Fund or the African Development Bank, on the basis of projected net benefits. All the World Bank and Asian Development Bank projects, including the Karnataka Watershed Development Project in India and the Loess Plateau Watershed Rehabilitation Project in China, are examples of this mode of financing.
5. **Donors give grants**: Another possibility is for these country governments to persuade international donors, both bilateral and multilateral, to provide grants in proportion to either the project costs or the projected benefits to each country.

8.2 SUGGESTED APPROACH

Bearing in mind the political and economic realities of the two countries a combination of all these different means of financing is perhaps the most prudent approach. Taking a 'modular' approach to proposed sub-project interventions may help to facilitate the funding of discrete modules by different means.

9. CONCLUSIONS

Regional and Global Public Goods: The proposed EN-SAP Watershed Management sub-project in selected watersheds along six rivers in Ethiopia and Sudan can confer a range of regional and global public good benefits. A well-designed and implemented contingent valuation survey is probably the best method of measuring these benefits. The method involves creating hypothetical scenarios of different levels of benefits from watershed management and asking citizens living downstream (or visiting downstream areas) how much they are willing to pay for potential regional public good benefits. Other regional public good benefits may be measured using market-based approaches, such as the costs of dredging or flood damages avoided due to reduced soil erosion and sediment transport as a result of interventions in upstream watersheds. Global public goods are best measured using existing inflows of foreign assistance to these sectors (e.g., forestry development) as a proxy for the value placed by the global community on these benefits.

Benefit Cost Analysis: A systematic social and environmental benefit-cost analysis will reveal whether the (incremental) benefits outweigh the costs of such an initiative (which have to be calculated based on planned interventions and costs for different project components). A positive net present value (NPV) and economic internal rate of return (EIRR) (preferably higher than the social discount rate) will indicate an economically viable project. Distributional adjustments can be made to ensure that the benefits accruing to poor stakeholders are given a greater weight in net benefit calculations. Appropriate sensitivity and risk analysis are necessary since the benefits are sensitive to a range of factors including the discount rate used, the size of benefits and costs, and delays in the accrual of benefits. Such analysis will also provide a clearer insight into the relative benefits from different project components. Including environmental benefits in the benefit cost analysis has been shown to increase NPV and EIRR substantially. World Bank analysis has shown that NPV has risen even 150% and EIRR by 2 – 8 percentage points as a result of including local, regional and global environmental benefits.

Distributional impacts: Potential benefits to poor stakeholders can be 'adjusted' to reflect the higher social marginal utility of such benefits. If a majority of stakeholders are poor, such adjustments will increase the NPV and EIRR of the project.

Impacts on proposed EN-SAP projects: The proposed sub-project will also increase the potential impacts, benefits and economic viability of the other sub-projects being planned under the Integrated Development of the Eastern Nile (IDEN) project. In particular, the reduced downstream sedimentation will increase the life of existing and proposed hydro-electric projects, reduce future reservoir dredging costs and reduce the damages from future flooding downstream. Increased downstream water flow will improve the efficiency and efficacy of proposed hydro-power projects.

Financing options for the watershed management sub-project: There are five basic options to generate funds for the watershed management sub-project in Sudan and Ethiopia: (1) national governments pay; (2) citizens of each country pay through taxes or special collections; (3) project beneficiaries contribute; (4) national governments borrow from international financial institutions; and (5) donors give grants. While a mix of these is the realistic option, contributions from potential beneficiaries (from expected economic benefits) are necessary for the sustainability of project interventions and benefit streams.

Bottom-line: To be sustainable, the project has to provide sufficient incentive and motivation to the local stakeholders - farmers and herdsmen - living in these watersheds. The public good benefits of the proposed watershed management sub-project are only additional benefits. But good quality analyses of these benefits may help raise international funding support for the project as a whole.

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ANNEXURE 1: Terms of Reference of the Study

The Eastern Nile Subsidiary Action Program
Watershed Management Project

Global and Regional Public Goods in Watershed Management

1. Background

The Nile Basin Initiative ("NBI"), a partnership between the Nile Basin Countries, was officially launched in 1999. It promotes cooperation between the riparian countries and is guided by a Shared Vision to *achieve sustainable socio-economic development through equitable utilisation of, and benefit from, the common Nile Basin Water resources*. To convert this vision into action, the NBI has developed a Strategic Action Programme comprising two complementary programs. The Shared Vision Program, a basin-wide program to build trust and capacity, involving all member countries, and two Subsidiary Action Programmes aimed towards cooperative investments; one in the Nile Equatorial Lakes Region and one in the Eastern Nile Region.

1.1 Eastern Nile Subsidiary Action Program

The Eastern Nile Subsidiary Action Program ("ENSAP") includes the countries of Egypt, Ethiopia, and Sudan. As an initial step towards developing a regional, integrated, multipurpose program ENSAP is launching a first phase of projects that confirm tangible win/win gains and demonstrate joint action for the Eastern Nile countries. Seven projects have been identified, i.e. Eastern Nile Planning Model, Baro-Akobo-Sobat Multipurpose Water Resources Development, flood Preparedness and Early Warning, Ethiopia-Sudan Transmission Interconnection, Eastern Nile Power Trade Investment, Irrigation and Drainage, and Watershed Management. To facilitate the implementation of ENSAP activities and projects, the Eastern Nile Council of Ministers ("ENCOM") established an Eastern Nile Technical Regional Office ("ENTRO"), with legal authority to undertake all functions entrusted to it by ENCOM, including the power to receive and administer grant funding for its operations.

The Eastern Nile countries are in the process of developing a major and complex multi-purpose investment program, aimed at generating substantial returns to Eastern Nile cooperation. This will require thorough and thoughtful examination of long-term cooperative multi-purpose, multi-country investment opportunities and their potential cumulative benefits, costs and impacts. In the interim, there is an *imperative for action to generate short-term benefits*, and ENSAP has therefore adopted a two-track approach:

- ***Fast track*** will comprise a selection of small, but strategic sub-set of sectoral projects for accelerated preparation. The purpose is to demonstrate early results on the ground and tangible benefits from cooperation.

- ***Multipurpose track*** will launch the preparation of a multi-country, multi-purpose program of investment, developing a strategic approach, completing essential baseline studies, undertaking broad national, regional and international consultations, lining up project financing, and preparing a subsequent set of follow-on investment projects.

1.2 Watershed Management Project

The objective of the Watershed Management Project undertaken under the ENSAP umbrella is to *improve the standard of living of the populations residing within the*

watersheds of the Nile basin, reduce soil and water loss, improve agricultural productivity and increase food security, reduce sediment transport and siltation of infrastructure, reduce erosion and morphological changes along the river, decrease pressures on natural resources and prepare for sustainable development oriented investments. While project interventions will be largely on a national scale, watershed management in the Eastern Nile has local, sub-regional and downstream/regional implications and benefits and is directly linked to the sustainability of multipurpose infrastructure[25].

To show early results from cooperation up to two fast track watershed management projects will be developed in each of the Eastern Nile countries in the short term while the integrated work to develop a cooperative, high impact multi-purpose Eastern Nile investment program is on-going, including a watershed Cooperative Regional Assessment. The full-range of benefits from watershed management in the Eastern Nile will only be realized if there is a common understanding and agreement of the up- and downstream interaction in a watershed.

The preparation of an integrated watershed program, which is by its nature linked and needs to be designed to optimize synergies to any multipurpose infrastructure development plans in the Eastern Nile region, will require a holistic approach. Interaction between national level investments and regional studies will be addressed in the Cooperative Regional Assessment ("CRA")[26]. The CRA is a practical tool for identifying, assessing, and fostering opportunities for cooperative actions among sub-basin countries, for promoting the recognition and optimization of the benefits of cooperation, and for looking at synergistic effects of the program across sectors. The consultancy outlined in the present TORs will begin to lay a foundation for the CRA study[27].

1.3. Watershed management as a public good

Benefits associated with watershed management include anything to which societies attach value, are generally economic and environmental in nature, and have a broad range of implications as it pertains to both the upstream and downstream use of the water in the river system. Some of the benefits resulting from watershed management have the characteristics of public goods. A classic economic definition of a public good is one which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good. This implies that charging a market price is not effective (as free-riding can not be prevented), hence provision would not be attractive to the private sector. If excludability is difficult or costly, there is a case for public provision of (or contribution to the cost of providing) the good so that maximum economic benefit can be attained. Global and regional public goods are public goods whose benefits reach across borders and population groups.

It is essential to recognize that the publicness of a good does not automatically imply that all people value it in the same way, or for that matter that it is accessible to all. In establishing an EN regional public goods agenda it is, therefore, important to ensure that the top priorities of different population groups are being considered equitably. Within a project context, efforts should be made to capture and understand benefits from

[25] See also China Loess Plateau Knowledge Exchange and Study Tour report, September, 2004.

[26] See Terms of Reference for Cooperative Regional Assessment.

[27] Meanwhile, national level, fast track projects will be designed in a participatory process and will differ between countries and sites. In terms of technical interventions (only), these projects may involve typical technologies including terracing, agro-forestry, reforestation/afforestation, promoting good agrarian practices, grazing regulations, area protection, water harvesting, gully plugging, and/or indirect or directly addressing biodiversity protection in the catchment areas.

watershed management throughout all levels of society, i.e.: (i) individual – e.g. improved farming methods will lead to increased incomes for farmer; (ii) local – e.g. avoiding damage to local infrastructure from floods will improve prospects for community development; (iii) regional – e.g. decrease of siltation downstream can improve hydro power operations and thus regional electricity supply; and (iv) global – e.g. decreasing greenhouse gases through carbon sequestration will mitigate climate change.

Developing countries have limited ability to pay for the provision of public goods, whether international, regional or national. As international public goods have a spatial range across border and continents, the international community, through financial aid and technical assistance, has an interest to support projects that create such goods. The choice of whether or not to provide financing for a project that supports the enhancement of a regional public good depends, in part, on a cost-benefit analysis. A problematic issue when assessing benefits of public goods is that the benefits may not be easily quantifiable. In principle, benefits from risk reduction, e.g. reduced floods, reduced soil erosion and siltation, are the most amenable to cost-benefit analysis, but the practice is imprecise.

2. Objective

The objective of this study is to (a) define how the public good concept is most adequately applied to watershed management, and (b) provide a practical basis for assessing the extent and impact to which regional and global public goods are attained from undertaking watershed management projects in the Nile Basin, in particular with regards to the projects envisaged under the ENSAP umbrella. As regards the latter (b), the study should in particular provide guidance on how regional and global public goods affect:

(i) Economic performance and justification of the envisaged projects;
(ii) Distribution of benefits and costs within the project area; and
(iii) Eligibility and access to financing from funding sources for the envisaged projects.

3. Scope of Work

Through research, literature review and gathering lessons learnt from relevant similar assignments and projects[28], the Consultant shall analyse the impacts of a watershed management project, undertaking the following tasks.

(i) ***Define public good in the watershed context***. Undertake a literature review of relevant concepts surrounding the idea of public goods and effective management of transboundary water resources, in particular as regards watershed management, to define the principle of the identified public goods and how externalities are allocated. A comparative analysis of case studies and projects undertaken may be beneficial in order to assess how the definition can be operationalised. Relevant such case studies should be agreed on upon between the consultant and client.

(ii) ***Cost-benefit analysis***. The consultant shall develop and apply a basic and simple to use method that can quantify order of magnitudes of economic costs and benefits associated with watershed management interventions, in particular as envisaged under the envisaged ENSAP project. An assessment of cost efficiency of watershed management interventions should also be made, i.e. comparing it with alternative interventions, both on a general level, as well as in relation to the envisaged ENSAP project.

[28] Considering the short term assignment, the Consultant is not expected to gather empirical data, but rather rely on secondary sources.

(iii) ***Distributionary implications***. The Consultant will analyse how costs and benefits are distributed among different stakeholders, i.e. countries and regions of the basin, as well as different segments of the population, e.g. urban vs. rural, income groups, and gender. The Consultant shall in particular assess how the project and the associated public goods contribute to poverty alleviation and improved livelihoods within different communities.

In performing this assignment the Consultants shall elaborate briefly on how the ENSAP watershed management project would link to and *broadly* affect an envisaged multipurpose project that may include the bundling of multi sectoral projects across Eastern Nile river systems and national borders, e.g. upland watershed management combined with a hypothetical future scenario of cascading systems of reservoirs across countries to generate hydropower, provide storage for flood and drought management, regulate flows for downstream uses, such as irrigation and water supply, and provide for continued sustainable wetlands and ecosystems functions. Such an assessment may best be done through some analogous cases and comparison with projects in other areas of the world.

The results from this assignment, including references to lessons learnt in other regions, should be compiled for use at a regional watershed management workshop to be organized towards the end of 2005, including a power point presentation, the report and a synthesis of the report for distribution, as well as training material.

4. Deliverables

The main reports to be prepared by the Consultant are listed below. This list is not exhaustive and the Consultant may be required to provide input on specific issues that may arise as the assignment evolves.

Report	Contents	Timetable
Inception report	Presentation to ENTRO of approach to undertaking the assignment, e.g. understanding of assignment and tasks, preliminary outline of main report, bibliography, list of potential comparison cases, as well as other outputs suggested by the Consultant.	1 week after appointment.
Draft report	Report in all essential respects structured as agreed with ENTRO, all issues researched, the story line clear, with preliminary findings emerging.	4 weeks after having received comments on inception report from ENTRO.
Final draft report	Final draft of report delivered to ENTRO, with copy to the World Bank, based on comments received on previous drafts, including other agreed outputs, e.g. any models and spread sheets of calculations.	2 weeks after having received comments on draft report from ENTRO.
Final report	Based on comments received on the final draft, the Consultant will finalize the report and submit it to ENTRO and the World Bank. Simultaneously a Power Point presentation based on the report and for the occasion of the regional workshop shall also be submitted.	1 week after receiving written comments from ENTRO and the World Bank.

All reports shall be submitted in the English language and presented in both paper and electronically using Word for Windows and all spreadsheets should be in Excel for

Windows. Two paper copies of every final written report shall be submitted to ENTRO and the Bank respectively.

5. Implementation Arrangements

The Consultant will report to, and be supervised by, an assigned official in ENTRO. The Consultant shall in all aspects of the tasks to be carried out within this assignment cooperate closely with ENTRO. ENTRO, in turn, will:

- Appoint a counterpart for the Consultant and provide all required support for the Consultant to complete the assignment and achieve objectives;
- Facilitate access to relevant authorities, as required, in the process of gathering relevant economic, technical and regulatory information relevant to the assignment.

6. Time table

The Consultancy is expected to commence the assignment in May-June 2005. The estimated total input of the Consultant is 20 working days. The Regional Workshop is scheduled to take place during the second half of 2005.

ANNEXURE 2: The Nile Basin Initiative (NBI) and the Eastern Nile Subsidiary Action Programme (ENSAP)

THE NILE BASIN INITIATIVE

The Nile Basin Initiative (NBI) is a regional partnership between the nine Nile basin countries of Egypt, Ethiopia, Sudan, Uganda, Tanzania, Democratic Republic of Congo, Kenya, Rwanda and Burundi. It was officially launched in 1999 to provide a forum for the cooperative development of the water resources of the Nile River.[29]

Goals and Objectives

Shared vision: The goal of the NBI is to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.

Objectives: The NBI aims to:

6. Develop the water resources of the Nile in a sustainable and equitable way to ensure prosperity, security and peace for all its people;
7. Ensure efficient water management and the optimal use of the resources;
8. Ensure cooperation and joint action between the riparian countries, seeking win-win gains;
9. Target poverty eradication and promote economic integration; and
10. Ensure that the program results in a move from planning to action.

Thematic Focus

The various programmes of the NBI encompass the following thematic areas:

- Water
- Biodiversity
- Poverty eradication
- Forests
- Drought
- Institutional framework for sustainable development
- Energy for sustainable development
- Agriculture
- Protecting and managing the natural resource base of economic and social development
- Sustainable development for Africa
- Changing unsustainable patterns of consumption and production
- Sustainable development in a globalizing world

Background

Started in 1993, the Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin (TECCONILE) was the first initiative by different countries to cooperate on the use of the resources of the Nile. The same year, TECCONILE launched a series of conferences with the support of the Canadian

[29] Most of this information is from the website www.nilebasin.org.

International Development Agency (CIDA) to initiate a dialogue among the Nile Basin countries and with the international community. This effort leads to the preparation of Nile River Basin Action Plan in 1995.

In 1997, the Council of Ministers of Water Affairs of the Nile Basin States (Nile-COM) asked the World Bank to lead and coordinate donor support for their activities. This led to the World Bank, CIDA and the United Nations Development Programme (UNDP), becoming cooperating partners to facilitate dialogue and cooperation among the Nile Basin countries. Following a dialogue in 1998 among all Nile basin countries (except Eritrea), a historic transitional mechanism for cooperation was launched by the Nile COM in February 1999 in Dar-es-Salaam. This was officially termed the Nile Basin Initiative in May 1999.

In 2000, a draft cooperative framework consisting of general principles, rights and obligations, and institutional structure was drafted by a Panel of Experts (POE) consisting of three-person teams of senior government lawyers and water resource specialists from each country.

Legal Status

On 6th November 2002, the Headquarters Agreement was signed between the Government of Uganda and the Nile Basin Initiative (NBI). This major breakthrough in the history of cooperation of the Nile Basin countries was meant to facilitate the establishment and operation of the **Nile Basin Initiative Secretariat at Entebbe, Uganda,** and to give the NBI diplomatic status within Uganda, and the necessary legal recognition to enable it perform its functions and to effectively facilitate the work and programs of the Nile Basin Initiative.

Operational Structure

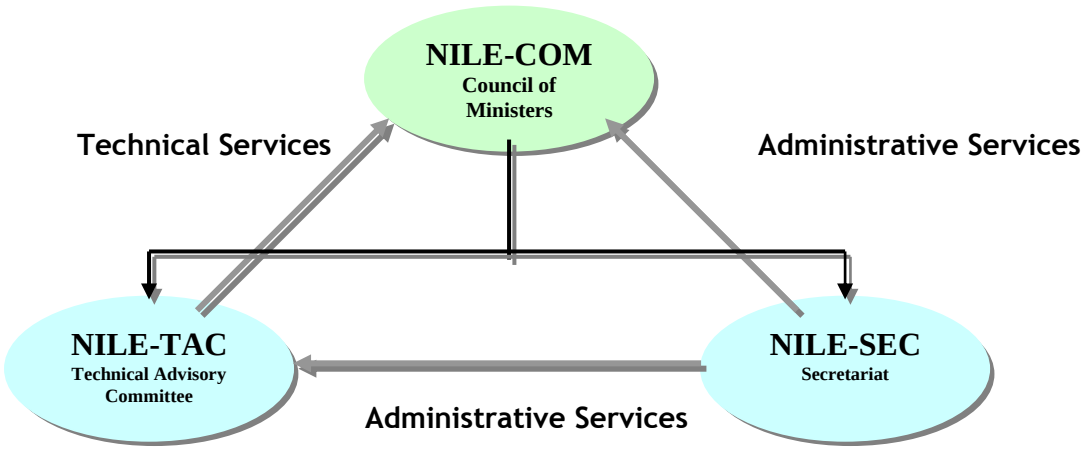

Figure A1: Operational Structure of the Nile Basin Initiative

Nile Council of Ministers (Nile-COM): The Council of Ministers of Water Affairs of the Nile Basin Countries (Nile-COM) provides policy guidance to the NBI and takes decisions on matters relating to management of Nile waters. (See Figure A1). The Nile-COM serves as the highest decision-making body of the NBI, and is made up of Ministers of Water Affairs of the Nile Basin Riparian Countries. Its Chairpersonship is on a rotational one-year basis. The current Chairperson of the Nile-COM is Prof. Bikoro Munyanganizi, Minister of Water, Rwanda.

Nile Technical Advisory Committee (Nile-TAC): The (Nile-TAC) renders technical advice and assistance to the Nile-COM. It currently has 18 members from the 9 riparian countries

as well as invited observers from the World Bank, UNDP, CIDA and other external partners. Its Chairpersonship rotates yearly among the Nile basin countries. The current Chairperson is Mr. Bruno Mwanafunzi, Director of Water and Sanitation, Rwanda.

The Nile Basin Initiative Secretariat (Nile-Sec): The (Nile-SEC) executes decisions of the Nile-COM and works to ensure the efficient and effective administration, financial management and logistical support to the Nile-COM and Nile-TAC as they carry out their responsibilities and work programs. This core function of the Secretariat is financed by the riparian countries themselves – in a show of commitment to and ownership of the NBI process.

STRATEGIC ACTION PROGRAMME

To convert its vision of *sustainable socio-economic development through equitable utilization of, and benefit from, the common Nile Basin Water resources* into action, the NBI has developed a **Strategic Action Programme** consisting of two complementary programs (see Figure A2):

- The Shared vision Program: A basin-wide program to build trust and capacity; and thus a foundation for cooperative action; and
- Two Subsidiary Action Programmes: One in the Nile Equatorial Lakes Region and one in the Eastern Nile Region, aimed towards cooperative investments.

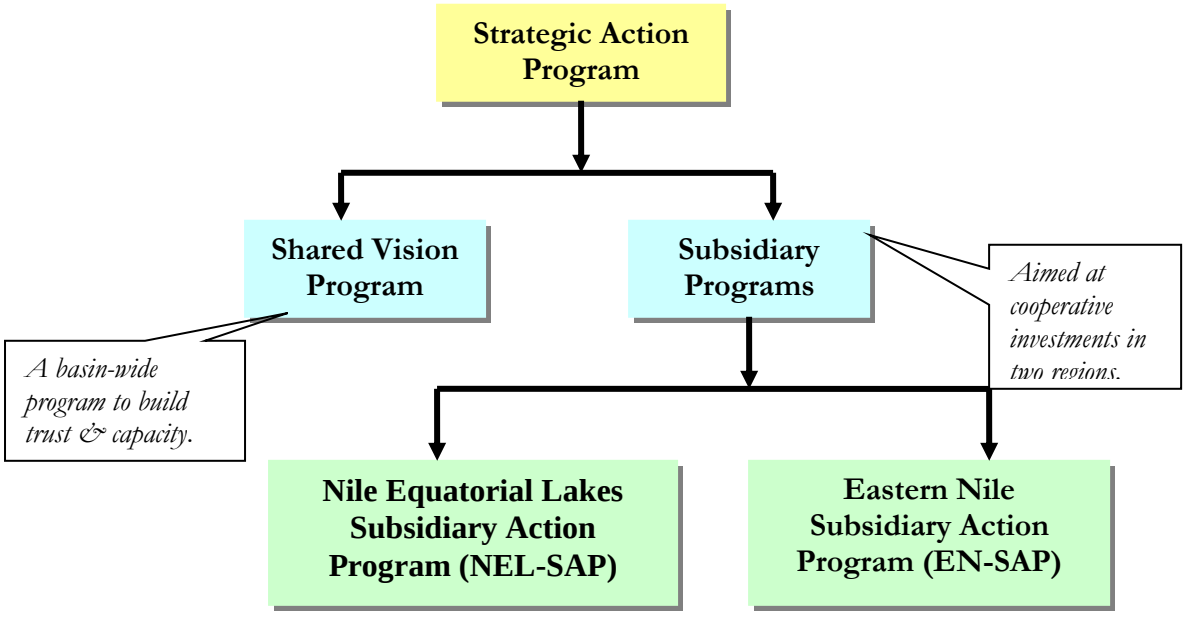

Figure A2: Investment Programmes of the Nile Basin Initiative

The NBI process is now in a critical transition stage, moving from project planning to implementation, and as such, the NBI institutional framework has been modified to meet this challenge and expanded the role of the Secretariat to include direct support and coordination of the Shared Vision Program and to the NBI's two investment programs: the Eastern Nile Subsidiary Action Program, which is based in Addis Ababa, Ethiopia, and the Nile Equatorial Lakes Subsidiary Action Program, which is based in Kigali, Rwanda.

Shared Vision Program - *Building a Foundation for Cooperative Action*

The basin-wide Shared Vision Program (SVP) currently comprises seven projects, aimed at developing the river to ensure more water, food and electricity, in a sustainable manner, to all those who depend on it for sustenance, and to reduce their vulnerability to droughts and floods. Four of these are thematic in nature, addressing issues related to environmental management, power trade, efficient water use for agriculture, and water resources planning and management. The remaining are facilitative, supporting efforts to strengthen confidence-building and stakeholder involvement, applied training, and socio-economic development, benefit-sharing and coordination.

All designed by the NBI countries, these projects aim to help building a strong foundation for regional cooperation by "supporting basin-wide engagement and dialogue, promoting common strategic and analytical frameworks, developing practical tools for sharing information and developing models to better understand the intricacies of the river's hydrology and the different development scenarios that could play out along the river." (www.nilebasin.org/svpProgramBriefs.htm).

Subsidiary Action Programs - *Seeking Mutual Benefits and Investments on the Ground*

Two Subsidiary Action Programs are being developed: The Eastern Nile (EN-SAP) currently includes Egypt, Sudan and Ethiopia; while the Nile Equatorial Lakes Region (NEL-SAP) includes the six countries in the southern portion of the Basin, as well as the downstream riparian Sudan and Egypt. These subsidiary groups have identified joint investment opportunities which warrant further investigation and preparation.

THE EASTERN NILE SUBSIDIARY ACTION PROGRAM (EN-SAP)

The Eastern Nile Subsidiary Action Program (EN-SAP) includes the countries of Egypt, Ethiopia, and Sudan. These countries are in the process of developing a major and complex multi-purpose multi-country investment programme for the region as a whole. As a first step towards developing this regional, integrated, multi-purpose programme, ENSAP has launched the first project – called the Integrated Development of the Eastern Nile (IDEN) - aimed at confirming and demonstrating tangible gains. IDEN comprises the following seven sub-projects:

1. Eastern Nile Planning Model
1. Baro-Akobo-Sobat Multipurpose Water Resource Development
2. Flood Preparedness and Early Warning
3. Ethiopia-Sudan Transmission Interconnection
4. Eastern Nile Power Trade Investment
5. Irrigation and Drainage, and
6. Watershed Management

With the establishment of the Eastern Nile Technical Regional Office (ENTRO) in Addis Ababa in June, 2002, the institutional mechanism to carry out the regional Subsidiary Action Program is now in place and functional.

ANNEXURE 3: Social Discount Rate & Social Marginal Utility of Income

Social Discount Rate

The rate used to discount future net benefits is critical to evaluating economic viability of projects. The large theoretical (economic as well as philosophical) literature on what the 'appropriate' social discount rate should be, have argued for an infinite social discount rate (which reflects the position that the current generation has no obligations to future generations), a positive rate, a zero discount rate (reflecting the view that the present generation's moral obligations to future generations (e.g., children) warrants a greater weight for future benefits), and a negative rate (the future is worth sacrificing the present for) (Hanley and Spash, 1993).

In practice, an arbitrary positive rate between 6 and 12% is commonly used in benefit-cost analysis (reflecting the philosophical view that the present generations have moral obligations to the future, but the future is given a lower weight than the present). There is a allusion to two actual rates of interest: (1) the investment rate of interest, which reflects the likely returns of funds in their best alternative uses (the opportunity cost of capital) and (2) the consumption rate of interest, which is the rate at which people are willing to save in the country (or the rate at which the value of consumption falls over time). Ultimately, however, the choice of a discount rate is somewhat arbitrary.[30]

Thus, the World Bank (Belli, 1996) simply states that it has not 'traditionally' calculated a discount rate 'but has used 10-12 percent as a notional figure for evaluating Bank-financed projects' (p. 132). It also admits that 'this notional figure is not necessarily the opportunity cost of capital in borrower countries' and is 'more properly viewed as a rationing device for World Bank funds' (*id.*). It however allows Task Mangers of specific projects in individual countries to use a different discount rate 'as long as departures from the 10-12 percent rate have been justified in the Country Assistance Strategy' (*id.*).

Social Marginal Utility of Income

The social utility of income going to individual *i* is the value placed by society on that income. Social marginal utility is the value placed on one additional unit of income accruing to that individual. Thus, society (or more accurately, the person doing the valuation on behalf of a notional society) can express a preference for assigning a larger value to a unit of income going to a poor person as compared to a better-off person. In terms of formal economics, the social marginal utility of income is the marginal change in the social welfare function (that maps the welfare of society given the welfare of its individuals, which is most commonly represented by their incomes) given a marginal change in the income accruing to individual *i*.

There is a long literature on social marginal utility of income going back to Alfred Marshall's 19th century argument that a pound taxed from a rich person and given to a poor person raises social welfare, and Vilfredo Pareto's elegant arguments (in a book titled *The Circulation of Elites* published in 1900) that it would not, unless the rich person 'gave' it away for altruistic reasons (i.e., left the person feeling 'as well off as before'). Lionel Robbins' critique in the 1930s of the impossibility of making any inter-personal comparisons of utility (which may be crudely paraphrased as 'if two people eat the same type of ice-cream, it is impossible to tell who enjoyed it more') was however overshadowed the same decade by the creation of Benefit Cost Analysis by the US Army

[30] Lind (1982) is an extensive survey of the economic and philosophical foundations of the social discount rate, but is inconclusive.

Corps of Engineers, who were faced with the practical problem of finding out whether or not the Tennessee Valley Project was economically feasible. BCA thus aims to value in crude money terms, all benefits and costs across different sets of individuals on account of a proposed project. Although they did not bother putting BCA into the theoretical framework of welfare economics, the subsequent work by I.M.D. Little and John Mirlees, Partha Dasgupta, Anthony Atkinson and others in the late 1960s and early 1970s helped provide practical measures of benefits and costs that had welfare theoretic roots.

Starting with UNIDO, the widespread adoption by the method for project appraisals by almost all major international lending agencies like the World Bank, the Asian Development Bank and the Inter-American Bank, has established its practical and theoretical credentials today.

Atkinson's epsilon 'inequality aversion parameter' is a practical method to incorporate distributional adjustments to net benefit measures in a BCA, based on the assumption that society has an 'aversion' towards inequality.

ANNEXURE 4: Bibliography of Relevant Literature

This bibliography refers only to the specific literature relating to the measurement of benefits and costs of watershed development programmes. Literature on public goods, environmental benefits and costs in general, and on the valuation of environmental benefits and costs has not been detailed in the bibliography but have been referred to in the main text of the report, with appropriate citations in the list of References.

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ANNEXURE 5: Classified Bibliography of Relevant World Bank Reports

A numbered annotated bibliography of various World Bank reports on 38 relevant projects have been classified in the Table below under the following 12 heads.

1. Global and regional benefits from watershed development
2. Integrated watershed management
3. Soil and Water Conservation
4. Afforestation
5. Biodiversity conservation
6. Irrigation and drainage
7. Management of Lakes
8. Community driven approaches, including alternative livelihoods, for poverty alleviation
9. Adverse project impacts & Environmental and Social safeguards
10. Transboundary Issues
11. Integrated approaches to water management
12. Lessons from Past Projects

References in the Table classifying these projects are to this numbered bibliography.

Head		Projects listed in the Bibliography by		Relevant issues being tackled by the Project
		Number	Project Name	
1	Global and regional benefits from watershed development	15 16	**Bhutan** - Land Management Project – Environmental Assessment & Social Assessment	To help realize local, regional and global environmental benefits from sustainable land management planning, land use and improve livelihoods in Bhutan.
2	Integrated Watershed Management	32 33	**Kenya -** Western Kenya Integrated Ecosystem Management Project Integrated Safeguards Data Sheet & Environmental Assessment	The project seeks to improve the productivity and sustainability of land use systems in selected watersheds in the Nzoia, Yala and Nyando river basins through adoption of an integrated ecosystem management approach, with community participation.
		34	**Armenia** - Yerevan Water and Wastewater Project : environmental assessment and environmental management plan	Expected impacts for water infrastructure, and mitigation measures for anticipated damage to natural landscapes and ecosystems, water flow reduction, disturbance of land and aquatic ecosystems, drinking water pollution and land erosion and landslides
3	Soil and Water Conservation	1	**Tanzania** - Lake Victoria Environment Management Project - environmental and social management framework	Integrated soil and water conservation in surrounding watersheds to offset anticipated negative environmental and social impacts of proposed project
4	Afforestation	13	**Benin** - Forests and	Socially, technically and economically

Head		Projects listed in the Bibliography by		Relevant issues being tackled by the Project
		Number	Project Name	
			Adjacent Lands Management Program Project	viable management of forest and adjacent land resources by communities, within a strengthened institutional framework
		29	**Kazakhstan** - Forest Protection and Reforestation Project : environmental assessment and management plan	Project aims to improve reforestation, forest fire management, and planting on the dry Aral seabed, and rangelands management, anticipates environmental risks and proposes measures to mitigate them.
		22	**Costa Rica -** Financing environmental services	Pioneering initiative to achieve environmental goals by creating markets for the environmental benefits of forests
5	Biodiversity conservation	4	**Namibia** - Namib Coast Conservation and Management, Project information Document	Environmental problems in coastal watersheds and lack of coordinated policies
6	Irrigation & Drainage	9	**Iran** - Tehran Drainage and Irrigation Improvement Projects	Building capacity for integrated operation and maintenance of irrigation infrastructure, as well as a dispute resolution mechanism
7	Management of Lakes	1	**Tanzania** - Lake Victoria Environment Management Project	Integrated soil and water conservation in surrounding watersheds
		23	**Global -** Integrated lake and reservoir management : World Bank approach and experience	Recommends: (1) comprehensive water resources planning; (2) apt analytical tools and techniques, such as cost-benefit analysis and environmental assessments
8	Community driven approaches, including alternative livelihoods, for poverty alleviation	7	**Azerbaijan** - Rural Environment Project Information document	Establishes national park & aims to reduce pressure on natural resources and ecosystems and mitigate potential negative impacts of increased restrictions on forest & pasture use, by helping local communities develop alternatives and improve traditional economic activities
		8	**Iran** - Local Development Fund Project : environmental assessment	To enhance the effectiveness and efficiency of community driven development interventions for poverty alleviation, through strengthening the role and capacity of local governments and civil society organizations in selected disadvantaged areas
		14	**Timor Leste -** Third	Participatory Development and

Head		Projects listed in the Bibliography by		Relevant issues being tackled by the Project
		Number	Project Name	
			Agriculture Rehabilitation Project	Natural Resources Management, to support upland communities, by promoting improved self-reliance, and natural resources management to strengthen communities ' resilience, and make them less vulnerable to external shocks (such as periodic droughts and chronic food insecurity). To help institutionalize three basic services to farmers including agribusiness support.
		37	**Nepal** Providing the poor with secure access to land in the hills	Using 40-year renewable leases, small blocks of public forestland transferred to groups of poor households, which they regenerated, protected, managed, and used drawing on financial, technical, and institutional support provided throughout the project.
		12	**Guatemala** - Drivers of sustainable rural growth and poverty reduction in Central America	To generate substantial gains in poverty reduction and broad-based growth, complementarities between productive, social, and location-specific assets must be addressed
		5	**Armenia -** Rural Enterprise and Small-Scale Commercial Agriculture Development Project	Support development of small and medium-scale rural businesses by improving the ability of farmers and rural entrepreneurs to access markets and by stimulating market-oriented private and public investments in rural areas.
9	Adverse project impacts & Environmental and Social safeguards	2	**Tanzania** - Agricultural Development Program Project : environmental and social management framework	Interventions to reduce potential negative social and environmental impacts
		3	**Tanzania** - Agricultural Development Program Project : resettlement policy framework	Principles and objectives of proposed government resettlement policy
		17	**Bhutan** - Decentralized Rural Development Project - environmental assessment report and environmental management framework	Anticipates negative environmental impacts, including soil erosion and sedimentation, and proposes measures to mitigate them including

Head		Projects listed in the Bibliography by		Relevant issues being tackled by the Project
		Number	Project Name	
		18 19 20	**Laos -** Nam Theun 2 Hydroelectric Project : Environmental Assessment & Social Assessment Social & Environmental Management Framework	Key environmental impacts of dam construction associated with changes to hydrology, water quality, erosion rates, climate and groundwater, aquatic and terrestrial habitats, species diversity, protected areas, and endangered species. Key social and environmental safeguards to mitigate these negative impacts
		21	**Global -** Good dams and bad dams: environmental criteria for site selection of hydroelectric projects	Simple, yet robust, methodology to compare proposed hydroelectric project sites in terms of their expected negative environmental impacts. Also environmental mitigation options for large dams.
		35	**Philippines:** Safeguards thematic review of decentralized projects	Findings and recommendations which focus on improving project performance and environmental and social sustainability through risk reduction and quality enhancement in subprojects on watershed management; reforestation, forestry; rural enterprise; and natural resource management .
		38	**Albania -** Water Resources Management Project : environmental assessment	Potential environmental impacts include sediment accumulation in canals, deterioration of water quality downstream and groundwater sources, and disturbance to localized ecosystems. Mitigations include regularly inspecting and clearing canals, deep ploughing, using water efficiently, maintaining drains, monitoring groundwater levels and salinity, restricting nitrogen application on fields, providing health awareness to farmers, managing the watershed, and using river training works and inspecting and reporting riverbank erosion.
10	Transboundary issues	6	**South Asia & Pacific** - Environment strategy for the World Bank in the East Asia and Pacific Region	Emphasises the need for systematic country-level and regional policy dialogue and partnerships with government, the private sector, civil society, and development partners to address national, cross-boundary and regional/global environmental issues in an increasingly integrating and globalizing region
11	Integrated approaches to water	10	**China** The World Bank and China's environment 1993-	Reviews World Bank activities in response to China' s environmental problems, including land degradation,

Head		Projects listed in the Bibliography by		Relevant issues being tackled by the Project
		Number	Project Name	
	management		2003	water pollution and water resources management.
		36	**Global** Stimulating innovative performance and supporting World Bank operations in water management	Outlines the mission of the Bank-Netherlands Water Partnership Program (BNWPP), i.e., to increase water security, through new approaches in integrated water resources management.
		31	**Canada** - Institutional and policy analysis of river basin management: the Fraser River Basin	Describes and analyzes a nongovernmental, multi-stakeholder, consensus-based approach to river basin management in the Fraser River basin in Canada
		11	**China** - Ningbo Water and Environment Project : environmental assessment	Key environmental issues include impact on downstream river of Jiaokou reservoir due to diversion of water and on natural wetlands
12	Lessons from past projects	25	**Saint Lucia -** Watershed and Environmental Management, and, Emergency Recovery and Disaster Management Program Projects	Perils of inadequate attention to design, including taking into account the motivation and perceptions of key stakeholders, lack of early training and support and triggering unexpected and negative effects when intervening in the natural behaviour of rivers.
		24	**Dominican Republic**, Irrigated Land and Watershed Management Project	Lessons from an unsatisfactory project, including the lack of political will and inadequate information and monitoring systems
		27	**Morocco** - Second Large Scale Irrigation Improvement Project, and Irrigated Areas Agricultural Services Project	Quite good performance on physical objectives was nullified by inattention to institutional objectives and, at project closure; so, the level of budget support was higher and cost recovery lower than at the start of the project.
12	Lessons from past projects (continued)	28	**Morocco -** Lakhdar Watershed Management Project	Lessons learnt include trained implementing agencies' staff to be able to explain the project's objective and implementation mechanisms to all the stakeholders, gain their confidence and establish partnerships, emphasizing the need for natural resource conservation and management as a condition for sustainable development and growth, and that participatory projects experience slow disbursements during the first year or two because of their slow take-off.

Head	Projects listed in the Bibliography by		Relevant issues being tackled by the Project
	Number	Project Name	
	26	**Ethiopia** - Ethiopian Social Rehabilitation and Development Fund Project	Key lessons learned include realistic project targets, simple and flexible design, timely and appropriate capacity building support, strategic and sustained approaches for gender promotion, and different approach to income generating activities from social sector activities
	30	**India** - Diversified Agricultural Support Project, Implementation Completion Report	Key lessons include, people's incentives and attitudes is a pre-requisite for agricultural transformation. Commercialization and private sector involvement is necessary for raising rural incomes. Use of beneficiary groups as entry points for project activities improves participation and beneficiaries ' capacity to absorb project-supported changes. Input and service supply based on full-cost recovery is feasible provided quality and timeliness are assured

1. Tanzania - Lake Victoria Environment Management Project - Supplemental Credit

This Supplemental Credit to Tanzania in connection to the Lake Victoria Environment Management Project (LVEMP) is associated with Project execution which was beyond the borrower ' s control, given that the LVEMP is a regional project. In particular, significant delays have been experienced with project implementation in Uganda, and Kenya over the course o f the last two years. The additional finance is considered necessary because of unforeseen cost overruns, because due to the unanticipated delays in the Partner countries, Tanzania is now facing a cost overrun, and if the Government of Tanzania (GOT) is to continue implementation alongside Uganda and Kenya, additional resources will be required. This supplemental credit would finance LVEMP work between now and 31 December 2005. Specifically, the agreed work program includes the following items: a) Fisheries Research; b) Fisheries Management; c) Water Hyacinth control; d) Water Quality and Ecosystem Management; e) Wetlands Management; f) Integrated Soil and Water Conservation; g) Catchment Afforestation; h) Support to Riparian Universities; i) Micro projects; j) Community Participation; and, k) National Regional Secretariat. The proposed Supplemental Credit would help ensure realization of the expected benefits of promoting sustainable use of the natural resources of the Lake, and its catchment. Procurement will include civil works, goods and equipments; and, consultancies and training.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000012009_20040930125816

2. Tanzania - Agricultural Development Program Project : environmental and social management framework Vol. 1 of 1 (English) Environmental Assessment

This environmental and social management framework for the Tanzania Agricultural Development Program Project identifies potential impacts and proposes measures to mitigate them. The critical environmental problems already facing Tanzania include land degradation; lack of accessible, good quality water; environmental pollution such as water contamination; loss of biodiversity, habitat, and wetlands; deterioration of aquatic systems; and deforestation. It is anticipated that the project will exacerbate these impacts, particularly, diminished land productivity from topsoil loss, soil erosion, surface runoff or contamination, and habitat runoff; water quality degradation from

sedimentation, nutrient overload, and inadequate liquid and solid waste disposal; degradation of river beds from river bank erosion, deforestation, landslides and flooding from river siltation; deterioration of watershed; unsustainable land use practices resulting in large-scale habitat destruction, loss of wildlife, and disappearance of national parks; risks to public health-including increased death rates among vulnerable populations due to polluted drinking water; disappearance of unique animal and plant species, decreased forest cover, and loss of genetic base caused by population pressure, lack of control and monitoring, and lack of regulations or poor enforcement of protective laws. The main adverse social issues which could be aggravated include acute poverty; increased illness and death from infectious diseases, such as HIV/AIDS; the vulnerabilities of women and the exclusion of vulnerable groups; lack of access to social services and micro-finance. A number of standard mitigations to reduce these risks will be used, including training in soil conservation methods, restoring and building new anti-erosion infrastructure, introducing crop rotation, controlling bush burning and fires, preventing gully formation, promoting public health and hygiene, management of household waste and solid waste, enforcing pollution control laws, locating sub-project away from water sources, promoting alternative energy sources, strengthening natural resource management, decreasing overgrazing, promoting agroforestry, protecting species, establishing buffer zones, protecting soil surfaces during construction, daily site cleaning, damping down dust, suitably storing building materials, locating latrines safely from wells and using closed sewage drainage systems, restricting construction times, periodic monitoring, and providing social services.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000160016_20050817132327

3. Tanzania - Agricultural Development Program Project : resettlement policy framework

This resettlement policy framework for the Tanzania Agricultural Development Program Project covers the principles and objectives governing resettlement preparation and implementation, describes the process for preparing and approving resettlement plans, the land acquisition process and likely categories of impact, eligibility criteria fro defining project affected persons, the legal framework, methods for valuing affected assets, organizational procedures for delivering entitlements, the implementation process, grievance redress mechanism, arrangements for funding resettlement, mechanisms for public consultation as well as procedures for monitoring implementation. Until the exact project sites are determined, it is not possible to estimate the likely number of people affected, however the report defines the categories of affected individuals, affected households, and vulnerable households, including AIDS afflicted persons, unmarried women, the elderly, orphans, street children, women-headed households, small-scale female farmers, and non-farming females. Communities permanently losing land and/or access to assets and or resources under customary rights will be eligible for compensation. Adhering to World Bank principles, compensation will be land-for-land, at replacement cost, paid for crop loss, include income restoration, include land tenants, entitle owners of non-permanent buildings to in-kind compensation or cash compensation at full replacement cost including labour and relocation expenses before displacement, entitle owners of permanent buildings to in-kind compensation or cash compensation at full replacement cost including labour and relocation expenses prior to displacement, and provide for compensating perennial crops. Other assistance comprises a moving allowance, food during construction of new site, a disturbance allowance, 6-months rent equivalent (to tenants) for disturbance, and possible employment with civil works contractors.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000160016_20050817135706

4. Namibia - Namib Coast Conservation and Management Project Vol. 1 of 1 (English) Project information Document

The Namibian coast is a hyper-arid ecosystem. The Namib Desert runs along the whole length of the coast, extending beyond the Orange River into the north-western corner of South Africa – an area known as the Richtersveld – and beyond the Kunene River into the southwestern corner of Angola. Much of the coast consists of sandy beaches with isolated outcrops, although there are also significant lagoons, estuaries and riverbeds present on the coast. Because the region, which is isolated between the ocean and the escarpment, is considered to be a constant island of aridity surrounded by a sea of climatic change, it has remained a relatively stable centre for the evolution of desert species. Therefore, the Namibian coastal habitats, together with the Succulent Karoo

biome of the southern Namib Desert hold significant and unique biological and ecological diversity, including uniquely adapted plants and animals, rich estuarine fauna and a high diversity of migratory wading and seabirds. The Namibian coastal ecosystems are extremely fragile and can easily be disturbed by human activities. Although the coast has been relatively inaccessible to date and shows geographically very concentrated population densities, human pressures on the coast's natural resources has been increasing over the past several years, highlighting the urgent need for sound coastal planning and management. The slow decentralization process has further complicated the situation, as regional and local authorities currently operate without a clear legal framework and with overlapping mandates and limited funds. Regional Councils, local authorities and line ministries' field staff lack the human, technical and financial capacity to undertake their duties as currently defined. Namibia already has a range of sectoral policies and strategies that deal with natural resource management, biodiversity and other coast-related matters. However, planning, implementation and assessment of coastal zone issues are currently fragmented and under the authority of several line ministries. There is also generally insufficient information available about the environmental and economic situation of the Namibian coast and the four administrative coastal regions and their contribution to national and regional development. This lack of information has resulted in the absence of a common vision for all stakeholders about the sustainable use of biodiversity and coastal zone resources. The vertical and horizontal interface between local and regional, and regional and national decision-making, as well as coordination between regions, is currently weak or non-existent.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000012009_20050803134438

5. **Armenia - Rural Enterprise and Small-Scale Commercial Agriculture Development Project Vol. 1 of 1 (English) Integrated Safeguards Datasheet**

The objective of the project is to support the development of Armenia's small and medium-scale rural businesses by improving the ability of farmers and rural entrepreneurs to access markets and by stimulating market-oriented private and public investments in rural areas. The main target groups of the project are small and medium-scale farmers and rural entrepreneurs who would benefit from improved information services, access to finance, improved inputs and technologies, and support for marketing activities.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000104615_20050413140544

6. **Environment strategy for the World Bank in the East Asia and Pacific Region Vol. 1 of 1 (English)- Departmental Working Paper**

The East Asia and the Pacific is growing faster than any other region. While rapid economic growth has contributed to significant improvements in human welfare, it has also led to profound socio-economic changes, and serious environmental implications such as air and water pollution, rapid depletion and degradation of natural resources, and the rapid loss of the region ' s rich biodiversity endowment. These, in turn, effect people ' s health, livelihood, and security, and compromise the potential of sustained growth and its benefits for future generations. This Strategy describes key environmental issues of development, provides an overview of the World Bank ' s environmental assistance to the region, and sets key objectives and a course of action for World Bank support to client countries in the region in the coming years. The Strategy is aimed to improve the quality of life, ensure the quality of growth, and protect the quality of regional and global environmental commons. It recognizes the different local and country contexts and develops a tailored approach to meet specific needs across different country groups through a range of Bank instruments, and calls for attention to local circumstances and the engagement of local communities and stakeholders in project design. At the same time, the Strategy also emphasizes the need for systematic country-level and regional policy dialogue and partnerships with government, the private sector, civil society, and development partners to address national, cross-boundary and regional/global environmental issues in an increasingly integrating and globalizing region. While future challenges are significant, the region has come a long way in its efforts to ensure environmental sustainability. This EAP Environment Strategy calls for enhanced collaboration among constituencies to improve the development impact of environmental assistance as a fundamental part of poverty reduction and development programs.

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7. Azerbaijan - Rural Environment Project Vol. 1 of 1 / Azerbaijan - Rural Environment Project (English)- Project information Document

The main instruments for achieving the project objectives will be the establishment of Shah Dig National Park (SDNP) and enlargement of Cordoba National Park (ONP), together with associated assistance for community economic development. The multiple-use PA model will allow existing residents of the park areas to remain in place, retain ownership of their land, and to engage in environmentally sustainable agriculture and other activities, based on jointly developed zoning and management plans. The community development aspects of the project aim to promote more sustainable livelihoods and economic activities in the project areas. In the short term the focus is on reducing pressure on natural resources and ecosystems and mitigating potential negative socio-economic impacts of increased restrictions on forest and pasture use, by helping local communities to develop alternatives and to improve the productivity and sustainability of their traditional economic activities, particularly livestock husbandry. The longer term objective is to promote a diversification of local economies, making them less dependent on mass consumption of natural resources.

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8. **Iran - Local Development Fund Project : environmental assessment**

The objective of the Local Development Fund Project for Iran is to enhance the effectiveness and efficiency of community driven development interventions for poverty alleviation, through strengthening the role and capacity of local governments and civil society organizations in selected disadvantaged areas of four provinces in Iran. The environmental review will identify potential environmental issues that might arise from proposed subprojects. The environmental guidelines will include details of environmental review procedures, institutional arrangements for environment as well as legal requirements. Any subproject, as a condition of approval, will be required to meet all environmental requirements and have in place all necessary approvals, licenses and certificates as required by the government authorities.

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9. Iran - Tehran Drainage and Irrigation Improvement Projects, Project Performance Assessment Report

Regarding the Tehran Drainage Project (TDP) the audit concurs, by and large, with the Implementation Completion Report (ICR) ratings, namely, in a satisfactory project outcome, and satisfactory performances by the Bank and Borrower, yet, it downgrades sustainability to just likely, upgrading institutional development impacts to substantial. As for the Irrigation Improvement Project (IIP), ratings differ from the ICR ' s, in that project outcome, sustainability, and institutional development impacts are downgraded to moderately satisfactory, likely, and modest respectively, but concurs on satisfactory performances by the Bank and Borrower. Experience confirms a number of the Operations Evaluation Department - OED - lessons: It is essential to understand sector institutions, their governance, incentive structures, and interrelationships before finalizing an investment operation. A first step is to ensure that all stakeholders are identified, and participate in project design. Failure to do so risks that some objectives will not be fully owned, and that lack of cooperation among key organizations, will jeopardize achievements. Whatever water infrastructure is provided or improved, a fundamental requirement for sustainability is building adequate technical, and beneficiary capacity to allow an integrated operation and maintenance, as well as a dispute resolution mechanism. This is particularly important when management is devolved hierarchically, and separated between a public service provider, and private users groups. Many countries have excellent human and technical resources, particularly in the private sector, and good project design needs to carefully balance the type, scale, and use of external and internal consultants. Too much foreign technical assistance undermines local ownership, and causes resentment - too little, risks inadequate capacity-building. Water conservation is difficult to achieve if the water fee structure is not linked to volumes of water used. In turn this requires investment in water measurement, monitoring and

recording equipment, and a willingness to abandon the crop and area basis for charging, as it provides no incentive to farmers to conserve water.

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10. The World Bank and China ' s environment 1993-2003, Working Paper

The magnitude and costs of pollution in China are still large, despite sustained government efforts over the last decade. China ' s environmental degradation has developed over centuries, but record recent rates of economic growth have now widened environmental impacts and accelerated many adverse trends. This paper examines the activities of the World Bank undertaken in response to China ' s environmental problems, among them air pollution-caused by ozone depleting substances especially, land degradation, and water pollution and water resources management. Many Bank sector projects and programs had positive environmental impacts but where there was a strategic intent it was not necessarily the Bank ' s. At sector-level environmental mainstreaming initiatives tended to be piecemeal, but Energy, Forestry, and Agriculture sectors developed comprehensive justifications and articulated a methodology. Transport projects became more environmentally oriented by gradual introduction of noise, traffic management and drainage components, responding to application of safeguard policies that revealed the pace of natural resource degradation and land use change. The report also discusses the strengths and weaknesses of the Bank environmental safeguards, the contribution of knowledge management and Economic and Sector Work, and the existence or effectiveness of the Bank ' s environmental strategy.

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11. China - Ningbo Water and Environment Project : environmental assessment

The executive summary discusses the China Ningbo Water and Environment Project environmental impact assessment and the risks and mitigation measures for this project. The project will facilitate the expansion of water and wastewater services in Ningbo City and Cixi City and consists of three components: (1) Ningbo Water Supply, part of Ningbo ' s overall plan to cover the entire City, improve water quality by accessing new water sources, upgrade water treatment and enhance the distribution system; (2) Cixi Wastewater which will provide comprehensive wastewater services for all urban areas in Cixi City and protect Hang Zhou Bay; and (3) Institutional Development to provide water planning, utility price and service regulation, and to enhance the Ningbo Water Supply Company (NWSC) and Cixi Municipal Sewerage Company (CMSC) operational and business management capacities. The key environmental issues are issues associated with the construction stage and operation stage, such as: (a) impact on downstream river of Jiaokou reservoir due to diversion of water; (b) water quality of Jiaokou reservoir (and Zhouaonazhai reservoir); (c) water quality in Cixi's canals network and marine environment; (d) Cixi's natural wetlands; (e) noise levels; (f) sludge; and (g) existing and planned wastewater treatment in Ningbo. The mitigation measures include preparation of detailed environmental specifications for the contractors; requiring a detailed construction program including phasing proposal for transport route and description of proposed disposal sites from the concerned contractors prior to start; ensuring procedures follow Chinese regulations and World Bank safeguards. The project will benefit the citizens of the project cities by improving their quality of life by increasing water supply quantity and quality in Ningbo and the enhancement of water quality in the Cixi canal network.

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12. Guatemala - Drivers of sustainable rural growth and poverty reduction in Central America - Guatemala case study Vol. 2 of 2 / Background papers and technical appendices (English)- Economic Report

This regional study encompasses three Central American countries: Nicaragua, Guatemala and Honduras. The focus of this report is Guatemala. The study is motivated by several factors: First is the recognition that sub-national regions are becoming increasingly heterogeneous, and economically differentiated as part of ongoing processes of development and diversification, with some areas advancing, and others being left behind. Second is the acceptance that one rural strategy does not fit all; design of an appropriately tailored rural strategy requires understanding the assets, markets, and institutions that frame household opportunities and livelihood strategies.

Third, rural heterogeneity requires identification of sufficiently homogeneous areas and household types to facilitate policy formulation, investment strategies, and project design. Fourth, there is a need to bridge the gap between conceptual strategies, and their timely implementation in order to obtain tangible and sustainable results. To this end, it is necessary to identify the appropriate sequencing, and complementary of investments in assets needed to drive growth and reduce poverty. The study ' s focus on assets is appropriate given historically stark inequalities in the distribution of productive assets among households in the region. Such inequalities are likely to constrain how the poor share in the benefits of growth, even under appropriate policy regimes. Rural poverty in Guatemala is characterized by three important features. First, geographic isolation, caused by varied topography, and inadequate transport networks, is an important correlate of poverty. The second dominant feature of rural poverty is ethnic exclusion. Poverty rates are far higher among indigenous groups and groups whose primary language is not Spanish. Third, rural poverty is concentrated in particular areas: that is, it has a particularly strong spatial dimension in Guatemala. Findings indicate that the high degree of overlap between high poverty rates, and high poverty densities in areas such as the Western Altiplano, means that investments there should reach significant proportions of the country ' s rural poor. Thus, to generate substantial gains in poverty reduction and broad-based growth, complementarities between productive, social, and location-specific assets must be addressed. Specifically, the report focuses on access to land, and strong local level institutions, and social capital, to compensate for lack of physical assets. This also requires a move from geographically untargeted investments in single assets, to a more integrated and geographically based approach of asset enhancement, with proper complementarities.

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13. Benin - Forests and Adjacent Lands Management Program Project Vol. 1 of 1 (English)- Integrated Safeguards Datasheet

The project development objective is to promote: "Socially, technically and economically viable management of forest and adjacent land resources by communities, within a strengthened institutional framework". The proposed project contributes to a countrywide National program which is for a 15 years duration, over three phases. The program duration is dictated by the time required for improved management approaches to yield significant changes on environment. The project covered by the current proposal will be implemented over five years, with GEF financial support. This project supports key PRSP goals and is fully linked to the approved poverty reduction support credit (PRSC). The proposed project is directly connected to pillars ii, iii, and iv of Benin's PRSP. It aims at strengthening the institutional capacity of the forestry administration as well as others stakeholders, promoting the participation of Community Based Organizations (CBOs) in the management of forest and adjacent lands, and sustaining contribution of forest resources to the well being of local population. The following activities are covered by the PRSC in the area of forestry and adjacent land management: (i) recruitment and training of additional foresters, and provision of sufficient funding and adequate equipment to the forest service, (ii) improving timber pricing, (iii) withdrawal of the State from timber plantations and processing, and iii) the review and update of forestry legislation. Thus the PRSC provides an excellent basis for the proposed project. The project is designed to build upon the promising experiences of the Natural Resources Management Project (Projet de Gestion des Resources Naturelles – PGRN) which closed in June 1999. The PGRN successfully tested a number of inter-related pilot activities consisting of community-based management of watersheds, wildlife reserves and gazetted forests. The successful approaches of the wildlife component is being replicated with the support of the Bank and the Global Environment Facility GEF), French Development Agency (AFD), European Union (EU) and the Dutch Development Agency. The Government, GTZ and AFD have replicated the community-based watershed management component through a stand-alone project (Programme de Gestion des Terroirs et des Ressources Naturelles – PGTRN) from 1999 to 2003. The African Development Bank is implementing a stand-alone project for the participatory management of the forests of D'Agoua, Monts Koufe and Wari-Maro.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000104615_20041207102850

14. Timor Leste - Third Agriculture Rehabilitation Project Vol. 1 of 1 (English) Project Appraisal Document

The Third Agriculture Rehabilitation Project aims to strengthen the capacity of the Ministry of Agriculture, Forestry and Fisheries (MAFF), and its key development partners to assist rural communities in increasing their production and income in a sustainable way. The project was designed with an emphasis on sustainability of activities, impact of achievements, and quality of outputs. The first component - Participatory Development and Natural Resources Management, will support MAFF ' s main assistance program to upland and coastal communities, by promoting improved self-reliance, and natural resources management to strengthen communities ' resilience, and make them less vulnerable to external shocks (such as periodic droughts and chronic food insecurity). Component 2 - Irrigation Rehabilitation and Management, will support MAFF ' s main assistance program to farmers in lowland irrigated areas, targeting about 4,000 rural families in all 13 districts, of which some 20 percent of members of Water User Associations (WUAs) are expected to be women. The third component - Services to Farmers, will help institutionalize three basic MAFF services to farmers: Information, Animal Health, and Agribusiness support. Finally, component 4 - Program Management, will help MAFF in project management, continue to develop key national policies, and, strengthen the Ministry ' s managerial and technical capacity.

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15. Bhutan - Land Management Project Vol. 1 of 1 / Environmental management framework (English) Environmental Assessment

The overall goal of the Bhutan Land Management Project is to help realize local, regional and global environmental benefits from sustainable land management planning, land use and improve livelihoods in Bhutan. The potential adverse environmental impacts from the project are likely to be small and limited. This operational framework document (OF) outlines the framework for planning, implementation and monitoring of environmental management measures required to ensure that potential adverse environmental impacts are eliminated, offset, or reduced to an acceptable level. The OF has been built on relevant existing national policies, legislations, regulations and guidelines, in concord with WB safeguard policy requirements. Some of the mitigation measures are : exclude the use of pesticides that are classified as Class I, IIa and IIb by the World Health Organization (WHO); use proper collection, storage and disposal methods for Farmyard Manure (FYM); apply chemical fertilizer to the lowest limit possible; conduct land capabilities studies and introduce alternatives to limit land degradation; focus on cross-breeding and maintenance of robust indigenous breeds pastures rather than replacing with exotic breeds; promote the use of vegetable dyes; promote harvesting mushroom varieties that do not have to be spawned on billets to limit degeneration of forests; and finally, construct proper stable, shed for keeping animals.

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16. Bhutan - Land Management Project Vol. 1 of 1 / Social assessment (English)

The overall goal of the Bhutan - Land Management Project is to help realize local, regional and global environmental benefits from sustainable land management planning, land use and improve livelihoods in Bhutan. It is highly unlikely the project activities will result in any significant adverse social impacts, including the physical relocation of people or the acquisition of privately owned land. Nonetheless, some of the mitigation measures are : facilitation of a multi-sectoral approach to community decision making on options for sustainable management to reverse or mitigate against existing or potential future land degradation; information dissemination, social mobilizations and strengthening of the chiog (group of households) role in local decision making; develop clear procedures for community orientation, mobilization and mapping of community resources and their utilization; develop chiog SLM strategies as well as mitigation and monitoring measures; develop clear procedures for disseminating information about the project to all affected communities; training for Field Coordinators; preparation of a chiog SLM annual plan; provide a feedback mechanism for these communities to voice their concerns and address these concerns; and finally, ensure that project benefits to vulnerable groups are maximized while adverse impacts are minimized or eliminated.

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17. **Bhutan - Decentralized Rural Development Project - environmental assessment report and environmental management framework Vol. 1 of 1 (English)- Environmental Assessment**

This environmental assessment and environmental management framework for the Bhutan Decentralized Rural Project anticipates negative environmental impacts and proposes measures to mitigate them. Avoid road construction within 50 meters of any cultural sites and in environmentally sensitive areas. To reduce erosion and sedimentation, plan proper drainage; specify side drain water discharge at every available stream crossing; specify erosion protection measures for all discharge structure locations and low-cost erosion protection measures. Minimize felling of trees and plant areas where vegetation has been damaged; avoid downhill disposal of excavated material; and designate safe places for disposal of debris. Carry out bioengineering on bare slopes and vulnerable areas. To control noise, ban blasting but where unavoidable and authorized, low-impact blasting techniques to be strictly employed during specified daytime hours. Construct catch drains to tap excess water and drain off natural streams and gullies. Protect slopes from grazing. Rehabilitate scarred areas with planting of indigenous tree species and other greening works. To limit seepage when building and operating irrigation systems, provide catch drains and drains under canal, construct covered canal, encourage use of dry land cultivation and/or tree planting above canal, divert any additional sources of water from slip area to nearby streams and other safer areas, and If necessary, extend down slope retaining wall foundation down to rock. Avoid construction of heavy retaining walls, breast walls and cross drainage structures; keep slope cutting to the minimum necessary; and keep clearance of trees and other vegetative cover along the canal alignment to the minimum necessary. Use local architectural features to the extent possible and design the physical features to gel with the surrounding landscape. Provide adequate sanitation facilities (septic tank, toilets, etc) in proportion to expected number of users. Construct temporary pit latrines for the workers; and pits for disposal of domestic materials. Identify safe places for disposal of excavated material and construction debris and dispose only in these places. After construction, rehabilitate areas that have been scarred during construction with planting of trees and flowers and other ornamental measures.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000160016_20041206142404

18. **Laos - Nam Theun 2 Hydroelectric Project : environmental assessment Vol. 15 of 22 / Fourth report of the International Advisory Group on the World Bank ' s handling of social and environmental issues (English)- Environmental Assessment**

The Nam Theun II Hydroelectric Project in Laos will dam the Nam Thuen creating a reservoir and generating power. Key environmental impacts of project operation are in the areas of physical and biological environment, associated with changes to hydrology, water quality, erosion rates, climate and groundwater, aquatic and terrestrial habitats, species diversity, protected areas, and endangered species. Hydrology impacts include impoundment of the Nam Thuen, diversion of water, and changes in flow. Water quality impacts include low dissolved oxygen concentration, increased nutrient concentrations in initial years, wastewater discharges from construction sites and work camps, and sedimentation from construction sites. Erosion and sedimentation impacts include changes in sedimentation in the reservoir and downstream and changes in riverbank erosion. Impacts on aquatic species include alteration of habitats, disfavouring certain species, imposing a barrier to migration, unfavourable conditions for species, alterations in species composition and productivity of the river; and damage due to sedimentation. Terrestrial biodiversity impacts include affects on land and vegetation including loss of land to reservoir, increased access to area, and increased human habitation. Other impacts include generation of minor micro-climatic changes on the plateau and affects on endangered species. Mitigation measures for these impacts are provided.

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19. **Laos - Nam Theun 2 Hydroelectric Project : Ethnic minority development plan Vol. 1 of 4 / Introduction and cross-cutting issues (English)- Indigenous Peoples Plan**

The Nam Theun 2 Project (NT2) involves the development of a hydroelectric scheme in Khammouane, Bolikhamxay and Savannakhet Provinces in central Laos involving constructing a dam on the Nam Theun River, creating a reservoir on the Nakai Plateau, and necessitating the relocation and rehabilitation of livelihoods of more than 1,000 households. The construction and operation of NT2 will result in impacts to the biophysical, socio-economic and cultural environments of the Project Area. Where resettlement will be required, project affected people (PAP) will be compensated for adverse impacts. Three areas of social impacts that are the subject of resettlement and/or compensation and development planning: the reservoir area on the Nakai Plateau, the project (construction) lands, and downstream (of the power station) and the XBF. Four ethnic groups will be affected: Tai-Lao, the majority population, and three ethnic minority groupings: Austro-Asiatic, Miao-Yao and Tibeto-Burman. The Ethnic Minorities Development Plans (EMDP) address the issue of culturally sensitive development for PAPs and aim to (a) Avoid adverse project impacts or to reduce and mitigate these; (b) improve the livelihoods and standards of living of the ethnic minorities; (c) ensure that ethnic minorities affected are adequately consulted, fully compensated and participate actively. Relevant material and recommendations in the EMDPs have been incorporated fully into the RAP and mitigation plans, although the EMDPs are much more detailed and provide background material justifying recommendations and conclusions.

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20. Laos - Nam Thuen 2 Hydroelectric Project : Social and environment management framework and 1st operational plan Vol. 1 of 2 / Management framework and operational plan (English)

This document describes the Social and Environmental Management Framework and Operational Plan (SEMFOP) for the watershed catchment area of the Nam Theun 2 Hydropower Project in Laos. It is the management plan for conservation of the NT2 watershed for the seven year period preceding filling of the reservoir and the start of commercial operation, and will also cover the first two years of the operation phase. The watershed comprises the middle and upper reaches of the Nam Theun River. The Nakai Nam Theun National Protected Area and its two corridors lie entirely within the watershed and contain a range of critical habitats, home to numerous species, many critically endangered and of global conservation concern. The NT2 Watershed is also home to approximately 6,000 indigenous people of diverse ethnic composition, and their livelihoods rely heavily on the forest, wildlife and natural resources of the NT2 watershed. The area is surrounded by a population undergoing rapid development, which are also partially dependent on the watershed's natural resource base and its forests. The SEMFOP describes the setting, institutional arrangements and management plans for the sustainable development and protection of the watershed and its inhabitants. It also presents baseline data aimed at providing a better understanding of the NT2 watershed, its natural resource base and the people living within it.

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21. Good dams and bad dams: environmental criteria for site selection of hydroelectric projects Vol. 1 of 1 (English)- Working Paper (Numbered Series)

This paper provides a simple, yet robust, methodology for comparing proposed hydroelectric project sites in terms of their expected negative environmental impacts, and relating these to power generation benefits. The paper also summarizes the environmental mitigation options for large dams. If properly implemented, these mitigation measures can effectively prevent, minimize, or compensate for many (though not all) of a hydroelectric project ' s negative impacts. Nonetheless, the most effective environmental mitigation measure is good site selection, to ensure that the proposed dam will cause relatively little damage in the first place. The paper presents quantitative indicators (using data that are relatively easy to obtain) for rating and ranking proposed new hydroelectric projects in terms of their likely adverse environmental impacts. Projects with a small reservoir surface area (relative to power generation) tend to be most desirable from both an environmental and social standpoint, in part because they minimize natural habitat losses as well as resettlement needs. In general, the most environmentally benign hydroelectric dam sites are on upper tributaries, while the most problematic ones are on the large main stems of rivers.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000090341_20041102151841

22. Financing environmental services : the Costa Rican experience Vol. 1 (English)- Working Paper (Numbered Series)

This paper outlines the rapidly evolving experiment in progress in Costa Rica, i.e., its pioneering initiative to achieve environmental goals by creating markets for the environmental benefits of forests. It describes the decades of deforestation, to the recent approach in valuing forestry benefits, and examines the private provision of environmental services, its transaction costs, and potential intermediaries to reduce transaction costs for small holdings. The major potential source for environmental services is described as the sale of Certified Tradable Offsets, that is, externally certified reductions in net carbon emissions, created through project activities which sequester carbon, or avert carbon emissions. Other sources of financing environmental services are explored as well, such as fuel tax, and watershed services, and, new challenges are reviewed on a wide range of factors affecting financing of environmental services. Among the conclusions, the creation of a model is suggested, to predict land use as a function of a property ' s location, and to establish the baseline against which carbon offsets are reckoned.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000094946_00081505312640

23. Integrated lake and reservoir management : World Bank approach and experience Vol. 1 (English)- Publication

This paper describes the challenges of managing lakes and reservoirs and the Bank ' s support of these activities. Specifically, it addresses water pollution, water withdrawals, diversions and lake reclamation; disturbances in watersheds; inappropriate introduction of exotic species; and overfishing. To alleviate the pressure on these water bodies, the report recommends a series of complementary measures, namely: (1) approaching water resources planning comprehensively; (2) using apt analytical tools and techniques, such as cost-benefit analysis and environmental assessments; (3) improving water resources allocation; (4) preventing and abating pollution; (5) focusing on applied research efforts that collect basic data on water and environmental quality, hydrology, and hydrogeology, and illuminate the interrelationships between lakes and reservoirs and the large freshwater systems to which they belong; (5) applying innovative technologies including spray irrigation systems and artificial wetlands; and (6) disseminating information on successful practices and proven technologies, such as farming practices. The World Bank will undertake a global water partnership supporting comprehensive management; develop supplementary policy guidelines, support collaborative preparation and implementation of programs and projects; integrate lake and reservoir management policy into its training programs for integrated river basin management and integrated coastal zone management; support preventative and restorative measures; and support a Lakes Management Initiative, a knowledge and experience bank.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000009265_3971110141423

24. Dominican Republic, Irrigated Land and Watershed Management Project, Vol. 1 of 1

Ratings convey an unsatisfactory project outcome, and unlikely sustainability, with modest institutional development impacts. Likewise, both the Bank and Borrower performances were unsatisfactory. Lessons outline the following, but most strikingly, the importance of a significant analysis of risks for fulfilling developmental objectives, particularly when dealing with known agencies within borrowers facing difficult circumstances. Among the many lessons, some specific ones reinforce and convey that projects with the objective to test methodologies for public interventions in the rural sector, need to ensure that baseline studies are available, and monitoring and evaluation systems in place to evaluate those methodologies, at the early stages of project preparation. This also leads to the issue of transfers of irrigation schemes from the public sector to water user organizations (WUOs), a process that requires political will, and adequate transfer policies and processes. In these cases, the Bank should make clear agreements with the Borrower before, or during loan negotiations on those policies and processes, and on the specific support needed to implement such processes. In addition, the participatory process of technology transfer requires both agronomic, and agro-economic analyses, therefore the monitoring system should

carry out agronomic and agro-economic studies to ensure that technologies and methodologies are profitable and sustainable. Notwithstanding, the costs per beneficiary of training, technical assistance, investment support and administration should be closely monitored, and contained within limits that are acceptable from a replicable point of view.

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25. Saint Lucia - Watershed and Environmental Management, and, Emergency Recovery and Disaster Management Program Projects, Vol. 1 of 1

Concerning the Watershed and Environmental Management (WEMP) Project the audit differs from the Implementation Completion Report (ICR) ratings in that it downgrades the project outcome to moderately satisfactory, sustainability to unlikely, and the Bank performance to satisfactory from a highly satisfactory rating; yet, concurs on substantial institutional development impacts, and a satisfactory Borrower performance. As per the Emergency Recovery and Disaster Management Program (ERDMP) Project, the audit largely concurs with the ICR ratings of a satisfactory project outcome, likely sustainability, substantial institutional development impacts, and satisfactory performances by both the Bank and Borrower. Lessons of experience are suggested as follows. The Bank needs to be more involved in the immediate post-emergency period, and it needs to be able to quickly fund activities that do not require detailed preparation, but it needs to take the necessary time to prepare infrastructure rehabilitation components that require careful attention to design. The experience of these two projects illustrates the perils of inadequate attention to design, including taking into account the motivation and perceptions of key stakeholders. In the absence of borrower staff experienced in Bank procurement practices, early training and support needs to be provided, especially under the time pressures that are normal for emergency operations. Specifically, when intervening in the natural behaviour of a river, it should be realized that there is a danger of triggering unexpected and negative effects. For this reason it is sometimes preferable to keep land adjoining rivers free of construction, and to allow the river to have some freedom of movement. Moreover, in order to work out a feasible action plan for watershed and environmental management it is imperative to identify the main constraints hampering sound management. In St. Lucia, constraints have included turf issues between relevant public institutions, the movement of farming to the hillsides, the nature of local crops, and local perceptions of hazards (causes and remedies). Therefore, with adequate preparation, infrastructure can be rebuilt in three years, but creating viable institutions at the national, district, and community level takes much longer. Grappling with well entrenched environmental bad practice is even more challenging and time-consuming.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000012009_20050802091016

26. Ethiopia - Ethiopian Social Rehabilitation and Development Fund Project, Vol. 1 of 1

The outcome for Ethiopian Social Rehabilitation and Development Fund was satisfactory, the sustainability was unlikely, the institutional development impact was modest, and the Bank and borrower performance were both satisfactory. Lessons learned from the project: Project targets must be realistic and design must be simple and flexible. Timely and appropriate capacity building support is key to subprojects implementation and sustainability. Gender promotion requires strategic and sustained approaches. Income generating activities are fundamentally different from social sector activities and require different approaches. Timely dissemination of economic and data analysis is essential. Parallel structures are efficient, but transitional in nature. Exit strategies require careful preparation and overall agreement between partners.

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27. Morocco - Second Large Scale Irrigation Improvement Project, and Irrigated Areas Agricultural Services Project, Vol. 1 of 1

The outcome of the Irrigated Area Agricultural services Project for Morocco is rated moderately satisfactory. The outcome of the Second Large-scale Irrigation Improvement Project (SLIIP) is rated as moderately unsatisfactory. These ratings are based on the relative importance of their objectives and taking into account their relevance, efficacy, and efficiency. The poorer outcome for the SLIIP is because quite good performance on physical objectives was nullified by inattention

to institutional objectives and, at project closure, the level of budget support was higher and cost recovery lower than at the start of the project.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000090341_20050722120438

28. Morocco - Lakhdar Watershed Management Project, Vol. 1 of 1

Project ratings are as follows: Project outcome is satisfactory; sustainability is likely; institutional development impact is substantial; Bank performance is satisfactory; and Borrower performance is satisfactory. Among the lessons cited were these: 1) Local community organizations must emerge and, to be viable, must evolve into legal entities with some level of financial autonomy. Their promotion should therefore be part of the project thrusts. 2)Participation requires implementing agencies staff to be trained, organized and able to explain the project ' s objective and implementation mechanisms to all the stakeholders, gain their confidence and establish partnerships. Frequent staff turnover should be avoided. 3) Partnerships with specialized nongovernmental organizations and micro-credit agencies afford good chances for providing the necessary technical and financial support for project activities. 4) Early involvement and support of regional and local authorities is a key to success. 5) Communities are willing to participate when they see tangible benefits and the possibility of generating added income from project activities. Project staff should therefore put emphasis on the need for natural resource conservation and management as a condition for sustainable development and growth. 6) Participatory projects experience slow disbursements during the first year or two because of their slow take-off. They subsequently have low levels of disbursements because of the small size of most community investments; the limited implementation capacity of emerging community organizations; and the scarcity of consulting firms and enterprises to work on small projects in remote rural areas.7) Land tenure issues affect participant ' s incentives and can seriously hamper implementation of any rural development project.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000160016_20050630093641

29. Kazakhstan - Forest Protection and Reforestation Project : environmental assessment and management plan Vol. 1 of 9 / Main report (English)

This environmental assessment and management plan for the Forest Protection and Reforestation Project for Kazakhstan, which improves reforestation, forest fire management, and planting on the dry Aral seabed, and rangelands management, anticipates environmental risks and proposes measures to mitigate them. Likely impacts and compensating measures include restricting traffic to avoid erosion and formation of tracks; using seeds from nearby regions and selecting species based on botanical and soil scientific research, and correctly using fertilizers and watering, and removing dead trees to prevent pest damage; conserving the nutrient capital of sandy soils to maintain productivity; supporting natural regeneration over artificial regeneration, especially in ecological and recreational zones where possible; using hand tools and light machinery in wintertime, and generally minimizing soil disturbance to lessen damage to the topsoil; siting fire prevention lookout towers and access roads, and mapping river habitats and protected areas to preserve ecologically valuable habitats; wearing face masks in dusty works to protect against radionuclide contamination; applying fire breaks to newly constructed roads; stopping excessive cutting for fuelwood, locating tree plantations close to inhabited areas and restore and enhance control of natural forests where possible; avoiding places where water or wind action may cause erosion and ban off-road traffic; preserving the most valuable habitats as nature reserves; locating wells to prevent overgrazing; and transporting, storing and using chemicals following natural regulations.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000160016_20050818161104

30. India - Diversified Agricultural Support Project Vol. 1 of 1 (English) - Implementation Completion Report

The ratings for the project were as follows: the outcome was satisfactory, the sustainability was likely, the institutional development impact was substantial, and the Bank and borrower performance were both satisfactory. The lessons learned indicate that changing policies, processes, institutions and people ' s incentives and attitudes is a pre-requisite for agricultural transformation. Commercialization and private sector involvement is necessary for raising rural incomes. Stability in

Project Coordinator and other senior staff, together with appropriate decision making authority and accountability, contributes significantly towards success. Administrative and financial decentralization need to occur together to be effective. Use of beneficiary groups as entry points for project activities improves participation and beneficiaries ' capacity to absorb project-supported changes. Input and service supply based on full-cost recovery is feasible provided quality and timeliness are assured. Early and adequate training in financial management for project staff, including concerned staff of implementing agencies/departments, is essential in view of the time required to absorb and apply these skills. Use of an independent agency for M & E improves quality and timeliness of reporting, contributing significantly to user-feedback and effective project monitoring and management.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000090341_20040923094638

31. Institutional and policy analysis of river basin management: the Fraser River Basin, Canada

The authors describe and analyze a nongovernmental, multi-stakeholder, consensus-based approach to river basin management in the Fraser River basin in Canada. The Fraser River drains 238,000 km2 of British Columbia, supporting nearly 3 million residents and a diverse economy. Water management issues include water quality and allocation, flood protection, and emerging scarcity concerns in portions of the basin. The Fraser Basin Council (FBC) is a locally-initiated nongovernmental organization (NGO) with representation from public and private stakeholders. Since evolving in the 1990s from earlier programs and projects in the basin, FBC has pursued several objectives related to a broad concept of basin " sustainability " incorporating social, economic, and environmental aspects. The NGO approach has allowed FBC to match the boundaries of the entire basin, avoid some intergovernmental turf battles, and involve First Nations communities and private stakeholders in ways governmental approaches sometimes find difficult. While its NGO status means that FBC cannot implement many of the plans it agrees on and must constantly work to maintain diverse yet stable funding, FBC holds substantial esteem among basin stakeholders for its reputation for objectivity, its utility as an information sharing forum, and its success in fostering an awareness of interdependency within the basin.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000090341_20050306122559

32. Kenya - Western Kenya Integrated Ecosystem Management Project Vol. 1 of 1 (English)- Integrated Safeguards Data Sheet

The project seeks to improve the productivity and sustainability of land use systems in selected watersheds in the Nzoia, Yala and Nyando river basins through adoption of an integrated ecosystem management approach. In order to achieve this the project will: (i) support on and off farm conservation strategies; and (ii) improve the capacity of local communities and institutions to identify, formulate and implement integrated ecosystem management activities (including both on and off-farm land use planning) capturing local and global environmental benefits. The project objectives would be achieved through a community driven development process whereby communities would decide on resources for infrastructure investments, technical assistance and implementation of ecosystem management activities. The overall goal for the project is therefore to improve ecosystem performance in terms of biological productivity, integrity, maintenance and sustainability while at the same time ensuring that these improvements can be adopted by farmers and decision-makers at various levels and that they result in poverty alleviation and farmer empowerment. A key element of IEM in the project will be linking upstream and downstream communities to better manage the river catchment as a whole. This will be accomplished through planning and financing of interventions that incorporate cross-community concerns.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000090341_20041025115041

33. Kenya - Western Kenya Integrated Ecosystem Management Project : environmental assessment, Vol. 2 of 2

The key development goals of the project are to reverse land degradation, and promote income-generating activities for rural farmers in Western Kenya, and, to contribute to improved rural water quality. The global objectives of the project are to create opportunities to sequester carbon, conserve biodiversity, and improve the quality of international waters. Major project activities

include: reforestation and afforestation, utilization of appropriate farming technologies, controlled grazing, introduction of improved fallows, improvement of soil fertility through agroforestry and chemical fertilizers, introduction of high value trees and fodder, promotion of livestock, flood control measures, various water management options, and, re-seeding of pasture. Although, potential environmental impacts of these activities were assessed, mostly positive, leading to improvements in environmental health, food security and a lower incidence of diseases, certain activities however, were identified as likely to lead to significant negative environmental impacts. It is probable that a massive afforestation/reforestation could negatively affect both surface, and groundwater supplies if care is not taken regarding selection of tree species, their placement on the landscape, and management. Use of chemical fertilizers could cumulatively make worse the eutrophication problems of the Lake Victoria ecosystem. The project could also lead to social disparities due to differences amongst communities, or social groups accessing project resources and information. This environmental management plan provides the following mitigation measures. Reduction of surface and ground water availability will be minimized by a select intervention of sites, tree species, tree management, and placement on the landscape carefully to avoid water source areas. Pollution of water bodies leading to their eutrophication, due to the use of chemical fertilizers and animal wastes should be mitigated by the application of the correct types of fertilizers, and the correct amount and timing of application.

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34. Armenia - Yerevan Water and Wastewater Project : environmental assessment and environmental management plan, Vol. 1 of 1

This environmental assessment for the Armenia Yerevan Water and Wastewater Project, which improves the efficiency, management, operation, deliver, and financial sustainability of water supply and wastewater services, anticipates negative impacts and proposes measures to mitigate them. Expected impacts for water intake structures, chlorinating stations, pump stations, sanitary protection zones, bank protective and flood protective structures include flooding, water pollution, reduction of spring water sources, damage to natural landscapes and ecosystems, water flow reduction, water basin pollution, disturbance of land and aquatic ecosystems, drinking water pollution with infectious disease spread, impact of protective barriers on aquatic systems, and land erosion and landslides. Likely impacts related to water mains and inter-city water supply network include affecting biodiversity, city landscapes, specially protected areas, historical monuments, human health, and the integrity of water lines. Also expected is surface water pollution with wastewater. The mitigation measures proposed are: repairing emergency nodes, making doors and manholes leak- tight, using inverse filters, creating a protective clay layer, rebuilding sewer lines, selecting spring intake method, implementing earthworks by hand, excluding explosives, carefully selecting where to build access roads, adapting soils brought during turfing and banking of spring intakes, landscape recultivation, undertaking hydro-geological and hydraulic studies, selecting correct technological solutions for the drainage system, managing water use, removing and neutralizing waters used for washing, training staff, providing appropriate sanitary-hygienic and working conditions for the service staff, applying new technologies, disposing of construction waste to appropriate landfills, installing fences, using gabion structures that do not interfere with fish flow, regularly cleaning mudflow canals, dosing water with chlorine, waterproofing structures, providing protective clothing for workers, collecting and disposing of wastewater, treating water to maintain quality if needed, and strictly applying safety and hygiene regulations

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000160016_20041026163022

35. Safeguards thematic review of decentralized projects in the Philippines, Vol. 1 of 1

This report focuses on four decentralized projects in the World Bank country portfolio for the Philippines: (1) Agrarian Reform Communities Development (ARCDP I and II); (2) Community Based Resource Management (CBRMP); (3) Local Government Unit (LGU) Finance and Development (LOGOFIND) and (4) Rural Finance III . In these projects centralized agencies administer and allocate funds to organizations and institutions that operate at the regional or local level to implement subprojects. The central agencies are supervisors of the use of World Bank funds and are required to adhere to project objectives, loan agreements, and fiduciary, environmental, and social safeguard measures. The subprojects covered by these four projects include: water supply and

sanitation; solid waste management; irrigation; agriculture; natural resource management; coastal resource management; watershed management; reforestation; fisheries; forestry; rural enterprise; farm to market roads (FMR); rural infrastructure; and natural resource management (NRM). The report gives finding and recommendations which focus on improving project performance and environmental and social sustainability through risk reduction and quality enhancement.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000009486_20041223114126

36. Stimulating innovative performance and supporting World Bank operations in water management Vol. 1 of 1 (English)

This brief report outlines the mission of the Bank-Netherlands Water Partnership Program (BNWPP), i.e., to increase water security, through new approaches in integrated water resources management. The driving force of the BNWPP is the understanding that the global water crisis, is in fact a water management crisis. Therefore, BNWPP focuses on water management reform, seeking to mobilize practical expertise at critical stages of the project preparation process. The program ' s action-oriented approach supports specific efforts, through the individual " windows " or themes, namely, capacity building; dams planning and management; environmental flow; flood management; groundwater management; international waters; livelihoods of the poor; reforming irrigation and drainage institutions; river basin management; wastewater management; water resources legislation and national strategies; water rights systems; and, watershed management. The report further provides interest points on each theme, supported by case studies.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000012009_20040609153948

37. Providing the poor with secure access to land in the hills of Nepal

The Hills Leasehold Forestry and Forage Development Project, initiated by the International Fund for Agricultural Development (IFAD) in 1989 and completed in 2003, was designed as a model for reducing poverty and restoring environmental balance in several districts in the hills of Nepal. Using 40-year renewable leases, the project transferred small blocks of public forestland to groups of poor households, which they regenerated, protected, managed, and used drawing on financial, technical, and institutional support provided throughout the project. The project focused on developing the feed and fodder base for livestock-both because poor people relied on these resources for their sustenance and because the environmental balance in the hills was dependent on them. The project led to significant changes in national policies, advancing the concept of leasehold forestry for poor people. Leasehold forestry is the only project in both the forestry and livestock sectors in Nepal that focuses exclusively on poor households.

http://www-wds.worldbank.org/servlet/WDS_IBank_Servlet?pcont=details&eid=000090341_20041208140658

38. Albania - Water Resources Management Project : environmental assessment

This is an environmental assessment for the Water Resources Management Project, which helps Albania increase the contribution of water resources for agricultural production. The irrigation schemes comprising this project are environmentally acceptable with negative impacts either nil or minor. This report discusses likely these negative social and environmental impacts and the measures proposed to mitigate them, which generally consist of engineering interventions incorporated into the design of the scheme, or modifications to farming practices (through training schemes) to reduce groundwater and drain pollution by agrochemicals. Potential negative impacts caused by the rehabilitation works during construction include disturbance, noise, and dust, and disposal problems. It is proposed to program work to minimize disruption during sowing and harvesting, avoid cultivated areas, and monitor construction activities. Also, these impacts are temporary and will cease when the works are completed. During the operational phase, potential environmental impacts may arise from sediment accumulation in canals, deterioration of water quality downstream and groundwater sources, disturbance to localized ecosystems, and hydrological disturbance (the latter is not expected in any of the six schemes). Mitigations include regularly inspecting and clearing canals, deep ploughing, using water efficiently, maintaining drains, monitoring groundwater levels and salinity, restricting nitrogen application on fields, providing health awareness to farmers, well water sampling (for nitrates, phosphates, and F.

coliform bacteria), managing the watershed, and using river training works and inspecting and reporting riverbank erosion.

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