Designing Projects within the GEF Focal Areas to Address Land Degradation: with Special Reference to Incremental Cost Estimation

Draft: Comments welcome

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1. Introduction

The Global Environment Facility (GEF) Instrument states that the agreed incremental costs of activities concerning land degradation, primarily desertification and deforestation, as they relate to the four focal areas, shall be eligible for funding (Article 3). Hence, the rationale for GEF' s involvement in land degradation remains consistent: it is for the achievement of global environmental benefits. GEF will serve as a catalyst, facilitator, and selective provider of funds to enable countries to meet the incremental costs of achieving global environmental benefits associated with the prevention and control of land degradation.

Land degradation is used in the GEF as a broad term, encompassing the "reduction of resource potential by one or a combination of processes acting on the land, including water and wind erosion, sedimentation and siltation, soil salinization and sodication, and long-term reductions in the levels and diversity of natural vegetation and crop yields" (GEF, 1996). The causes include climatic variations, as well as human activity such as inappropriate agricultural and water management practices, overgrazing, unsustainable commercial extraction of timber, excessive use of biomass, and population pressures resulting in deforestation.

1.1 Aim of the paper

The aim of this paper is to illustrate how projects could be designed to address land degradation through the four focal areas; with special reference to incremental costs assessment[1]. To achieve this aim we approach the question from a generic form through to specific examples. We use paradigm cases to make the points explicit.

1.1.1 The interface of land degradation with GEF's focal areas

Table 1classifies the way land degradation interacts with GEF' s focal areas. For example, GEF activities for conserving biodiversity can also prevent and control land degradation (e.g. by protecting threatened plant and animal species and habitats; by helping affected people to develop sustainable uses of biological resources that support their lives and livelihoods). This is illustrated in the Sudan case. Conversely, containing land degradation can protect and enhance biodiversity, as in the example from Ethiopia.

Similarly human activities through continued land degradation may increase atmospheric levels of greenhouse gases (GHGs). Preventing or controlling degradation could also substantially reduce GHGs, and enhance carbon storage: this is set out in the Mexico example. Conversely again, the threat of global warming to dryland populations and their resource base is also eminent; and the livelihood of people in these areas is increasingly put at risk by a process they cannot control. This is the case for Kazakstan.

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[1] This work is a continuation of earlier work which looked at incremental cost assessment in biodiversity through paradigm cases. Although we have prepared the paradigm cases to reflect the format of the Incremental Cost Annex, the primary emphasis of current work at PRINCE is on designing projects to *improve* the global environment to obtain *additional* global environmental benefits using the recently adopted project format.

International waters (lakes, rivers, coastal areas) are of paramount importance to dryland economies. Preventing and controlling land degradation can help control pollution of international waters and sustain aquatic ecosystems' productivity and integrity: and hence sustained livelihoods. It can also help protect freshwater and marine biodiversity (e.g. Lake Victoria).

Land degradation sometimes affects more than one of GEF' s focal areas, and should be addressed in each to capture the global environmental objectives: this is illustrated for the project in Senegal and Mauritania.

1.1.2 Conformity with Operational Strategy

To be (co)funded by the GEF for its global environmental benefits, a project must impact on one or more of the focal areas, and be consistent with the Operational Strategy. To meet the GEF goals in a consistent and cost-effective manner, the project must be conceived, designed and implemented strategically. The revised format for the project brief provides guidance for the project to be formulated to meet these requirements; i.e. it embodies the logic of designing projects explicitly to obtain global environmental benefits that would not otherwise accrue from actions that could be taken in the national interest alone.

Designing the project in this way can be helped by asking several questions, whether or not it is for land degradation (see Figure 1 for an overview). The first question which needs to be addressed for the project/site is: are there any important issues as relate to the global environment? This would help define the GEF entry point. If yes, then what are the threats or constraints operating which reduce the overall global environmental benefits? What causes these threats/constraints? What is the trend of these threats? Often the threats can be understood and identified from a rigorous analysis of the baseline situation. This analysis will help to determine if the baseline is consistent with the objective of sustainable development, and also how it relates to the broad development goals of the country.

The next set of relevant questions relates to what course(s) of action can be taken to remove or alleviate these threats to ensure that the global environmental objectives could be achieved in a most cost-effective manner. This should help to define the alternative strategy or the GEF intervention. The main cause and effects of adopting the alternative strategy should help define the scope of the analysis (or "system boundary") in physical, spatial and economic terms.

A key advantage of this approach is that it requires the link between the baseline course of actions and those proposed in the alternative to be made explicit. When the project is properly prepared in this way, the incremental cost is relatively easy to estimate. That is to say, the main analytical and strategic work must be undertaken anyway, to ensure that the project succeeds, and not just to satisfy a funding formula.

The GEF Council Paper on Incremental Costs (GEF/C.7/Inf.5) presents the GEF policy on estimating agreed incremental costs. Incremental cost is the additional cost of undertaking the alternative course of action relative to that of the baseline course of action. It is the extra burden on the country that would result from choosing the GEF supported activity (which would also generate global environmental benefits) in preference to one that would have been sufficient in the national interest alone.

It is increasingly apparent that a well-prepared project that shows how the activity (or activities) will "make a difference" to the global environment is relatively easy to cast in incremental terms, whereas poorly conceived projects are not too easily costed. More specifically, it is the difference between the costs of these alternative activities and the baseline activities that constitutes the incremental cost. The importance of defining and designing these activities is an essential part of the project and a critical part of incremental costs assessment.

The strategic approach and vision to incremental cost assessment affirms the incremental cost reasoning to be part of the "mainstream" thinking of good project design. That is to say, the GEF entry point into the project is intricately linked with 'achieving global objectives' and 'incrementality': this message should be reflected throughout the project design. Despite the logic behind this strategic approach it is not always articulated or made explicit in individual project designs.

1.1.3 Practical illustrations for the estimation of incremental cost.

In the context of land degradation, projects considered potentially eligible for GEF support are based on the strength of the linkage of prevention and control of land degradation with GEF's focal areas. National programs and development assistance aimed at achieving national benefits, such as raising agricultural productivity, improving food security and livelihoods, with or without specific interventions to control desertification or deforestation, are baseline. Incremental costs of generating the agreed global environmental benefits that would not have arisen from baseline development, including prevention and control of land degradation, are eligible for GEF financing.

The definition and articulation of baseline and alternative in designing projects within the GEF focal areas to address land degradation should concur with the Council guidelines, and be dealt with pragmatically. There may be situations, especially in the context of land degradation in very poor countries, where the operating baselines themselves are counter to national interests due to a variety and combination of factors. In these cases it may be necessary to look beyond to what would be necessary to have a sustainable baseline i.e. one which provide the transition from this expected downward trend of the baseline to one which ensures domestic resource sustainability.

Briefly, the baseline would represent the current course of action. A comprehensive elaboration of the baseline should help identify the main threats and root-causes. It should include a statement of malpractices which contribute to the land degradation process, drectly and indirectly, and which undermine the long-term sustainability of the natural resources

The sustainable baseline: should address these malpractices to ensure that the root causes of the threats are addressed. These activities would be in the direct interest of the country, and could be funded by the country, through co-financing or through development aid/grants.

The 'alternative' represents a course of action which goes beyond the baseline or sustainable baseline (whichever is the relevant one) to address those issues which have a bearing on global environmental benefits. These activities could be either additional, substitutional or both to the baseline (or sustainable baseline).

The paradigm cases in Section 3 provide practical illustrations for the formulation of baselines and alternatives[2]; and the estimation of incremental costs. The analysis, if conducted thoroughly, would shed light on the barriers to and the financial requirements to achieve the sustainable baseline. The question for GEF then is how they could act to remove barriers towards the correction of the baseline so that global environmental benefits could be secured (see the Sudan example).

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[2] Some of the paradigm cases which follow have used the terms baseline and sustainable baseline. Following the Biodiversity Task Force meeting this will be revised throughout the document and described as follows: (i) the expected course of events or "current trends", (ii) the sustainable development **baseline**, and (iii) the **alternative**. In this way the terminology will remain consistent with the Council guidance.

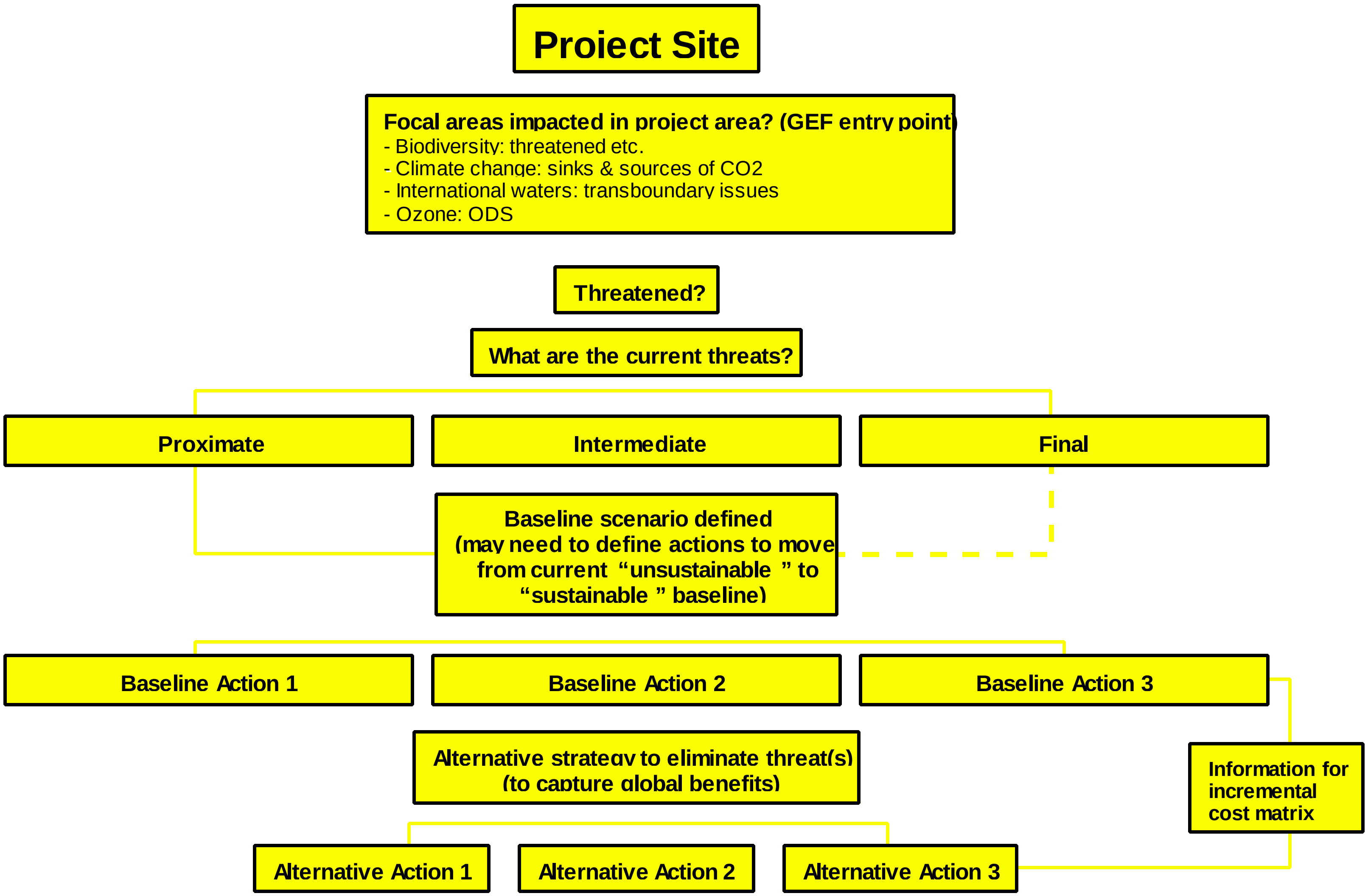
Reference:

GEF (1996) A Framework for GEF Activities Concerning Land Degradation. Global Environment Facility, Washington D.C.

TABLE 1: GENERIC FORMS OF FOCAL AREA ACTIVITIES IN RELATION TO LAND DEGRADATION

Focal area(s)	Generic forms (paradigm case illustration)
Biodiversity	• incremental costs of land degradation activities specifically needed to secure biodiversity conservation in the baseline (e.g. Ethiopia) • land degradation addressed in baseline, incremental costs for biodiversity conservation (e.g. Sudan) • choice of options to generate global benefits: one of which simultaneously addresses land degradation
Climate change	• protection of a carbon sink • creation of a carbon sink (e.g. Mexico) • restoration of a carbon sink • adaptation to climate change impacts (e.g. Kazakstan)
International waters	• pollution of waters due to land degradation: land degradation addressed in the baseline, incremental costs to facilitate improvements on an areawide basis in one or more focal areas (e.g. Lake Victoria)
Ozone	• alternative soil fumigants to reduce ozone depleting substances and which also reduce land degradation
Multiple focal-area	• those which address more than one focal area (e.g. Senegal and Mauritania)

Figure 1: Conformity with Operational Strategy



2. Background and summary of the paradigm cases

2.1 Background of each paradigm case

A total of six paradigm cases are presented. The details of each case are provided in the next section. The presentation of some of the cases is more generic and others more instructional: the intent in each case is to provide information and to illustrate how the interface of land degradation and GEF's focal areas translates into designing projects strategically; consistent with the GEF mandate.

We provide a box summary of each paradigm case, and the special issues that emerge out of each case.

2.2 Main features and issues addressed by the paradigm cases

Table 2 provides a summary of the main features and issues addressed through the paradigm cases. These issues in themselves may not be exhaustive, but rather illustrative. The aim is to demonstrate how these issues would provide for the projects to be designed more strategically, and in turn how the incremental costs assessment would be facilitated by a comprehensive treatment of the issues involved.

2.3 General conclusions

The paradigm cases provide worked illustrations on how to design projects for land degradation as they relate to the four focal areas under the GEF. A major conclusion which can be drawn from this, and other work, is that 'land degradation' type projects do not require special rules for them to be casted for GEF financing. The strategic project design can be consistently applied to land degradation issues, from the focal area perspective.

The special challenges may be in defining the baseline when there is often a lack of data, inconsistent policies, or even scientific uncertainty with regard to the (interactive) processes underway. These challenges and associated risks may also be associated with regular development projects. The best way forward is to be as explicit of the situation as far as possible, and to identify those activities or actions which 'definitely' undermine sustainability of the environment, and address these through more sustainable forms of activities and actions.

BOX 1

ETHIOPIA: FARMER-BASED APPROACH TO CONSERVE AFRICAN PLANT GENETIC RESOURCES AND CONTAIN LAND DEGRADATION PRACTICES

GEF entry point: to provide for continued and sustainable *in-situ* conservation of landraces of global and local significance through farmer-based approaches by arresting practices which contribute to land degradation

Problems/threats: shift from organic (manure) fertilizer to inorganic fertilizer in response to removal of a steady supply of the former, and cheaper cost of the latter as an alternative. The inorganic fertilizer has several adverse consequences in the context of land degradation: (i) on the farm itself; (ii) 'off-site' on land, and (iii) in waterways.

Approach: two steps:

- from current business-as-usual situation to sustainable baseline: national interests
- from sustainable baseline to alternative strategy: global interests

Baseline: biodiversity (germplasm) conserved through farm practices, but current practices (i.e. use of inorganic fertilizer) would contribute to land degradation and loss over time.
Alternative: encourage shift to organic fertilizer to contain land degradation and secure long-term biodiversity conservation.

Special issues:

- biodiversity (germplasm) farmed in the baseline, incremental costs for activities to contain land degradation and secure long-term biodiversity conservation
- need to shift from unsustainable to sustainable activities in the baseline
- scope of analysis extends beyond the farms to include relocated livestock industry
- costs of shifting to sustainable baseline are twice the incremental costs of shifting to the alternative
- need to identify barriers to the 'sustainable baseline', as well as to identify appropriate financing of these costs
- cost-savings/costs-avoided in adopting alternative strategy demonstrated

BOX 2

SUDAN: COMMUNITY-BASED RANGELAND REHABILITATION FOR CARBON SEQUESTRATION AND BIODIVERSITY

GEF entry point: arrests biodiversity loss and creates sinks for carbon sequestration.

Problems/threats: drought has desiccated the environment and reduced range productivity resulting in deterioration of rangelands by soil degradation, declining livestock and crop production patterns.

Baseline: land degradation addressed in the baseline
Alternative: to enhance further biodiversity conservation and reduce net emissions of GHGs

Special issues:

- addresses the cross-cutting areas of biodiversity and climate change with desertification/land degradation
- baseline seeks to improve the welfare of the local pastoral and agropastoral communities living in the project area
- the project uses a community-based approach to reducing global warming through carbon sequestration.
- barrier removal to facilitate global benefits
- timing of onset of baseline vs alternative activities
- cost-sharing for ‘ joint-benefits’ ?
- ability of the country to bear the baseline costs

BOX 3

MEXICO: ENHANCING LONG TERM (AND SHORT-TERM) CARBON STORAGE OF DEGRADED LAND

GEF entry point: improve net carbon sequestration through the creation of carbon sinks

Problems/threats: the extent of barren, abandoned, saline soils are leading to increasing extents of land degradation. This is brought about by the depletion of groundwater and increasing intrusion of sea water into deep wells. As salt is deposited in adjacent areas, there is further loss in soil productivity.

Approach: the use of non-forest biomass (e.g. halophytes) production to contain land degradation, and its concurrent benefit as a carbon sink in Sonoran, Mexico. Halophytes, as salt-tolerant terrestrial plants, act as biological desalinizers, and at the same time act as a carbon sink. This non-forest biomass could be planted in either a transitional (short-term) strategy or a long-term carbon strategy: the project explores the incremental cost assessment and other implications of adopting either of these strategies.

Baseline: business-as-usual: provide new irrigation sources
Sustainable baseline : planting of halophytes as a transitional strategy for re-establishment of agricultural crops
Alternative 1 : planting of halophytes as a transitional strategy for re-establishment of agricultural crops but with specific action to increase carbon storage underground
Alternative 2 : planting of halophytes as a long-term strategy, and facilitating the set-up of agro-industry to use the halophyte harvested

Special issues:
- demonstrates that ' business-as-usual' baseline to be unsustainable and less cost-effective than the sustainable baseline
- investigates the cost-effectiveness of two alternative strategies: a transitional short-term one and a long-term one
- demonstrates the effect of cost-savings
- a project which could be expanded and replicated elsewhere

BOX 4

KAZAKSTAN: ADAPTATION TO CLIMATE CHANGE IN RELATION TO LAND DEGRADATION

GEF entry point: adaptation to land degradation impacts as a consequence of the climate change phenomenon.

Problems/threats: increased precipitation in Kazakstan as a consequence of climate change will increase soil erosion, which has been identified as a high priority concern.

Approach: a need to ascertain through simulation models etc. the impact of climate change scenarios on soil erosion and general land degradation impacts

Baseline: costs of soil protection under stable climate
Alternative : costs of soil protection under conditions of ' climate change'

Special issues:
- need for scientific data locally and globally
- need for evidence on the processes and linkages

BOX 5

SENEGAL AND MAURITANIA: ASSESSMENT OF INCREMENTAL COSTS FOR A MULTI-FOCAL AREA THAT BUILDS ON LAND DEGRADATION AND REHABILITATION EFFORTS
(This is not a full paradigm case; but an illustration of how a project in its early formative stages should be scrutinized and analyzed strategically for GEF intervention)

GEF entry point: contain biodiversity loss, improve net carbon sequestration and address transboundary water issues

Problems: unsustainable harvests, destruction of biomass, forest clearance, loss of biodiversity, bushfires, change in water-flow in Senegal river, advance of sand-dunes, destruction of river-banks, over-grazing, extinction of species, land degradation, desertification, drought etc.

Proposed measures:

- dam: to steady water supply
- agricultural development
- development of forests:
- environmental training and management

Questions to be addressed

Q1. Will the proposed baseline measures or interventions contain the spread of desertification and land degradation? If not, what else needs to be done to ensure that the baseline is sustainable?
Q2. Will these measures, and added measures, also address global environmental concerns as asserted through the four focal areas? or will they in any way undermine them?
Q3. Which focal areas do the activities (or lack of them) impinge or interact with global environmental concerns?
Q4. How can the sustainable baseline activities be **modified** or **adapted** further to address these global environmental concerns?

Approach: two steps

- From current (business-as-usual) situation to sustainable baseline: national interests
- From sustainable baseline to alternative: global interests

BOX 6

KENYA, UGANDA AND TANZANIA: LAKE VICTORIA ENVIRONMENTAL MANAGEMENT PROJECT

GEF entry point: contain biodiversity loss in the lake ecosystem, and address areawide transboundary water concerns

Problems/threats: land degradation around the lake ecosystem, overfishing, resulting in severe water hyacinth infestation and unsuitability of water supply from lake.

Approach to project design:
Two steps:
- need for clear identification of issues acting at the level of the individual countries and collectively
- GEF' s role as a catalyst, to facilitate and co-ordinate concerted action at the country levels to achieve global benefits

Baseline: land degradation through human based activities addressed nationally
Alternative: to complement national initiatives, but address transboundary concerns of the lake as a whole

Special issues:
- challenge of identification of baselines at two levels: collectively and individually for each country: the baseline situations in each country may be very different
- intricacies of the facilitation role of GEF
- importance of targeted research

TABLE 2: SUMMARY MATRIX OF THE MAIN FEATURES AND ISSUES ADDRESSED

FEATURES/ISSUES	#1 Ethiopia	#2 Sudan	#3 Mexico	#4 Kazak-stan	#5 Senegal & Mauri-tania	#6 Lake Victoria
1. Focal area/global benefits						
• biodiversity	x	x			x	x
• climate change	x	x	x	x	x	
• international waters					x	x
• ozone						
2. Operational program coverage	1	1	1,2	1	1,2,9	1,8
3. Spatial scale of conservation						
• local/provincial	x	x	x			
• national		x		x	x	x
• regional					x	x
4. Domestic benefits						
• same physical outputs	x					
• same economic outputs		x			x	x
• greater benefits (see costs avoided/ scope of analysis)	x	x	x		x	x
5. Threat analysis						
• proximate	x	x	x		x	x
• intermediate	x	x	x		x	x
• ultimate						
• difficult to define						
◊ not sufficient data				x		x
◊ poor linkages				x		
◊ scientific uncertainty				x		x
6. Baseline strategy/activity						
• sustainable						
• not sustainable	x	x	x	x		x
• trend: towards sustainable						
• difficult to define						
◊ not sufficient data					x	
◊ inconsistent policy				x		
◊ policy and ground not consistent						
7. Alternative strategy/activity						
• substitution to baseline	x	x	x		x	x
• additional to baseline		x	x	x	x	x

cont' d

TABLE 2: SUMMARY MATRIX OF THE MAIN FEATURES AND ISSUES ADDRESSED

FEATURES/ISSUES	#1 Ethiopia	#2 Sudan	#3 Mexico	#4 Kazak-stan	#5 Senegal & Mauri-tania	#6 Lake Victoria
8. Stakeholder issues						
• addressed explicitly	x				x	x
• implicitly addressed			x			x
• not addressed		x				
• should be addressed		x	x			
9. Incremental costs						
• positive	x	x	x		x	x
• negative			x			
• break-even						
10. Incremental costs financing towards						
• conservation activities		x			x	x
• sustainable use activities	x	x	x		x	x
• benefit sharing						
• barrier removal		x	x			x
• capacity building		x	x			x
• technology transfer			x			x
11. Incremental cost financing avenues						
• grant						
◊ capital costs	x	x	x			x
◊ recurrent cum development costs	x	x	x			x
• trust fund						
• with conventional loan						
• re-allocation of baseline budget			x			
12. Baseline costs						
• zero						
• low compared to incremental costs		x	x			
• comparable to incremental costs						
• high compared to incremental costs	x					x
• not ascertained				x	x	
13. Baseline cost financing						
• national government	x	x	x		x	x
• international aid (other than GEF)		x				x
• development assistance		x				x
• other						
• not identified yet				x	x	
14. Source of material for case study						
• actual project (including PDFs)	x	x	x		x	x
• some (hypothetical but realistic) features added	x	x	x	x	x	

3. Paradigm cases illustrated

A. Ethiopia: Farmer-based Approach to Conserve African Plant Genetic Resources and Contain Land Degradation Practices

B. Sudan: Community-based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity

C. Mexico: Enhancing Long-term Carbon Storage of Degraded Land

D. Kazakstan: Adaptation to Climate Change - Link with Land Degradation

E. Senegal and Mauritania: Assessment of Incremental Costs for a Multi-focal Area that Builds on Land Degradation

F. Tanzania, Kenya & Uganda: Lake Victoria Environmental Management Project

PARADIGM CASE ON INCREMENTAL COSTS

A. ETHIOPIA: Farmer-based Approach to Conserve African Plant Genetic Resources and Contain Land Degrad ation Practices

Focal area: Biodiversity (& Climate change)

(BIODIVERSITY (GERMPLASM) FARMED IN THE BASELINE, INCREMENTAL COSTS FOR ACTIVITIES TO CONTAIN LAND DEGRADATION TO SECURE LONG TERM BIODIVERSITY CONSERVATION)

A. PROJECT BACKGROUND

The aim of this project is to contain land degradation practices which could serve to undermine farmer-based practices which provide for *in-situ* conservation of African plant genetic resources, by facilitating the use of organic fertilizers (manure) as the alternative to the prevalent use of inorganic fertilizers in the Addis province of Ethiopia.

B. INCREMENTAL COST ANALYSIS

1. Broad Development Goals

1.1 Production systems are evolutionary responses to population pressure, resource endowment and marketing opportunities. In this context, the broad development strategy of the country is one which is moving away from grazing and mixed farming systems towards industrial systems for livestock production. These industrial systems are intensive production systems, where livestock production is moved from its original land base and placed where it is most profitable.

2. Global Environmental Objective

2.1 The province of Addis in Ethiopia is one of the several areas of the world where crop plants were domesticated from wild species. The continued interaction of cultivated crop types with their wild relatives under diverse ecological, social and economic conditions has made Ethiopia one of the most heterogeneous areas of the world in terms of genetic diversity of land races. Landraces are genetically diverse forms of cultivated plants, and represent repositories of traits which have evolved in local environments over long periods of time. The rate at which they are being replaced by more recently developed varieties with narrow genetic base, has spurred international action to conserve this diminishing resource base. This genetic erosion has been addressed by global efforts to conserve plant genetic resources both as seeds and as living plants in off-farm or *ex-situ* gene banks.

2.2 There is, however, also an urgent need for conservation of landraces by farmers *in-situ* to be part of the existing cropping system. Conservation at the farm level allows for continuing farmer selection, interaction with the environment, and gene exchange with wild species so that evolution of landraces may continue. Because indigenous crop landraces are genetically diverse and well adapted to local agroecological and sociocultural conditions, they are of primary importance for the majority of the world's farmers working in low-input, subsistence agriculture.

2.3 A part of the project would lend itself to reduce net emissions of GHGs through the improved handling of manure (see below).

3. Baseline

3.1 In Ethiopia, the farmers have for long time been cultivating landraces of globally and locally significant crops such as wheat, barley, sorghum, teff, finger millet, lentil, chick pea, linseed and safflower (global biodiversity benefits are incidental). This forms the foundation of their livelihood: planting these landraces which are well-adapted to the natural environment and prevalent conditions represents a strategic response to minimize risks in crop harvests. They are not, however, immune to the appeal of shifting to higher yielding varieties or reducing their overhead expenses.

3.2 The farmers have over time been forced to alter their farming practices to accommodate to changes in their vicinity brought about by changes in the wider economy[3]. With the introduction of industrial livestock production systems, several of the grazing and mixed grazing farms have been relocated further away. With this relocation, the steady and fairly cheap supply of manure from these sources has been lost to almost 80% of the farmers.

3.3 While cultivation of a wide variety of crops (and the conservation of their germplasm) is the basis of their livelihood, the farmers continue to act in their own private interests: to cut costs and improve marketability of their crops. In this context, the farmers have resorted to the purchase of inorganic fertilizer from the commercial markets. Although organic fertilizer from the industrial systems is available, the transportation costs make it a more expensive option than inorganic fertilizer.

3.4 This shift from organic to inorganic fertilizer has three adverse consequences, all in the context of land degradation. The first is on the farm itself. Adding manure (as organic fertilizer) to the soil increases the nutrient retention capacity, improves its physical condition by increasing the water holding capacity and improves soil structure stability and enhances micro-flora and fauna. On the other hand, excessive application of inorganic fertilizer (with nutrients (N and P)) can disrupt these functions and thereby the viability of soil micro flora and fauna. Furthermore, if the addition to the soil of heavy metals exceeds crop uptake, it would ultimately pose human and animal health risks. The second adverse consequence is that the use of inorganic fertilizer will also contribute to land degradation effects 'off-site' beyond the farm boundaries, especially as leachate into the waterways. The third consequence has to do with the generation of vast amount of manure on these land-detached "bio-industries", for which there is no immediate user/use. This manure would be treated as 'waste', resulting in excessive loading of this manure on the limited land areas within reasonable distances from the producers.

3.5 Sustainability of farm-based landrace conservation may ultimately depend upon external market and non-market incentives for continuing their cultivation.

3.6 The current shift to inorganic fertilizers is not sustainable for the natural environment. In this context some steps should be taken to address the salient problems associated with the use of inorganic fertilizers. For example, the level of mineral in the soil and water should be monitored and these should

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[3] Although this particular situation is hypothetical in this context, it is a fairly typical one. It is used here to demonstrate its impact on land degradation.

be treated accordingly through appropriate practices such as liming etc. These activities are in the national interests and constitute a vital part of the ‘ sustainable baseline’ (SB).

4. The Proposed Alternative

4.1 In order to minimize the threat of land degradation to the continued *in-situ* farm practices to conserve critical plant genetic resources and landraces, the proximate threat posed by the prevalent shift to inorganic fertilizer must be removed or replaced by another alternative ‘ technology’ . The alternative strategy also has to ensure that the country is not ‘ worse off’ .

4.2 The alternative proposed here seeks to re-apply organic fertilizer to the farms which crop these important genetic germplasm. To do so, there would be a need to ‘ import’ this fertilizer from the industrial livestock systems. While it is difficult to generalize, transport beyond 15 km is often uneconomical due to the competitive prices of inorganic fertilizers.

4.3 Briefly, there are two important obstacles to the adoption of the alternative strategy of re-introducing organic fertilizer from the livestock industrial systems to the farm plots: (i) transportation costs, and (ii) the need for vast quantities of water for the transportation of this manure. The alternative strategy will seek to address and finance the additional costs of doing so, so as to secure long-term germplasm biodiversity conservation on the farmlands.

4.4 Improvement in storage methods could further reduce the loss of nutrients from manures, as well as GHG emissions, especially methane. To avoid these losses, manure collection and storage facilities need to be systematically designed so that they are most cost-effective for the alternative strategy.

5. Scope of Analysis

5.1 In this context although it is the farmers that are of primary interest in the context of the GEF project, the scope of analysis must be extended to look into the bio-industries which could provide a steady and consistent supply of manure. The impact of doing so on the farmer and the wider economy will have to be analyzed. The case reveals interesting situations of cost savings as well as concurrent benefits of doing so.

5.2 We investigate here briefly the overall impact of ‘ importing’ this manure back from the industrial systems. For the industrial system itself: these land-detached “bio-industries” emit large quantities of waste, resulting in excessive loading of manure on the land areas closest to production sites. Large amounts of water are also needed to drain surplus waste and chemicals, and this competes with water that is needed for fodder and feed concentrate production, and as drinking water for animals. Direct drainage of manure onto surface water and leaching from saturated soils is a feature associated with industrial systems. Nitrates contaminate surface water, leading to high algae growth, eutrophication and damage to aquatic and wetland ecosystems.

5.3 Thus although the transportation of manure from the industrial systems is an additional cost, it will at the same time reduce the water and land pollution in their sites of origination. This should reduce costs associated with the treatment of waterways etc.(i.e. there would be a cost-saving to the country of adopting the alternative). There would also be a further cost saving (albeit more trivial) in that it would reduced the demand for the import of inorganic fertilizer.

6. Costs and Results

6.1 The incremental cost matrix for Ethiopia is shown in Table 1. The main cost and benefit components associated with the baseline (B), sustainable baseline (SB) and the alternative (A) are presented.

6.2 With regard to the global benefits, shifting from the baseline which uses inorganic fertilizer to a more ' sustainable baseline' i.e. one which monitors and treats some of the impacts of the use of inorganic fertilizer, it is likely to improve partially the viability of the germplasm over the short-term. The shift to the alternative (A) situation which replaces the inorganic fertilizer with organic fertilizer would secure the long term conservation of the germplasm. Properly designed manure collection and storage facilities under the alternative could have the effect of reducing net emissions of GHGs. The stakeholder of these benefits is the global community.

6.3 The domestic benefits in shifting from the baseline (B) to the sustainable baseline (SB) would reduce water pollution as well as partially arrest land and soil degradation. The further shift to the alternative (A) would improve the domestic situation even further.

6.4 Only costs that are different between the baseline, sustainable baseline and alternative are shown, and are expressed for one hectare. The main costs under the baseline are those for the purchase of the inorganic fertilizer (@ $ 50/ha), and those for the sustainable baseline have two additional components: those associated with the monitoring of soil and waterways to check for pollution (@ $ 30/ha), and for the treatment of waterways (@ $ 50/ha). In the case of the alternative, the cost of purchasing the organic fertilizer is $ 100/ha (which includes the transportation of the fertilizer from the livestock production centers back to the farmlands), improved storage methods at $ 20/ha to further reduced net GHG emissions. Whilst the monitoring costs under the alternative remain the same as for the SB (@ $ 30/ha), the actual treatment costs of the waterways would be less with the use of organic fertilizer (@ $ 20/ha).

6.5 The present value costs over a 10 year period at 10% discount rate in shifting from baseline to sustainable baseline for the total area of farmlands (1,500 ha) is $ 0.81 million, and that from the sustainable baseline to the alternative is estimated at $ 0.42 million. The costs of the individual components are presented in Table 1.

7. Results

7.1 The results indicate that the present value incremental costs of shifting from the baseline to the sustainable baseline are $ 0.81 million compared to $ 0.42 million in shifting from the sustainable baseline to the alternative. That is to say that the costs in the national interests are almost double those to the global community.

7.2 It would be important to understand if there are any specific barriers that the country may face in making the shift from baseline to sustainable baseline.

Table 1: Incremental Cost Matrix for Ethiopia

	Baseline (B) (inorganic fertilizer)	Sustainable baseline (SB) (inorganic fertilizer + monitoring and treatment)	Alternative (A) (organic fertilizer)	Increment (SB - B)	Increment (A - SB)
Global Benefits	• crop germplasm biodiversity & viability threatened	• crop germplasm biodiversity & viability improved partially	• conservation and survival of crop germplasm biodiversity improved further • climate change: reduction in net emission of GHGs	•	• biodiversity (germplasm conservation)
Domestic Benefits	• land and soil slowly being degraded on farms • pollution of water-ways	• land and soil degradation partially arrested • water-pollution controlled & monitored	• land and soil degradation arrested even further • water-pollution controlled & monitored	> 0	> 0
Activities/ Capital & recurrent costs **(all costs per ha)**	• cost of purchasing inorganic fertilizer $ 50	• cost of purchasing inorganic fertilizer $ 50 • monitoring of soil and waterways to check on levels of pollution $ 30 • waterways treated for pollution from inorganic fertilizers $ 50	• cost of purchasing organic fertilizer (incl. transportation costs) $ 100 • improvement in storage methods of manure $ 20 • monitoring of soil and waterways to check on levels of pollution $ 30 • waterways treated for pollution from inorganic fertilizers $ 20		
Costs/ ha	**$ 50**	**$ 130**	**$ 170**	**$ 80**	**$ 120**
PV (10% d.r.) for 1,500 ha	**$ 0.51million**	**$ 1.32 million**	**$ 1.74 million**	**$ 0.81 million**	**$ 0.42 million**

Note: the costs are for illustrative purposes only, and do not reflect actual costs in the project.

PARADIGM CASE ON INCREMENTAL COSTS

B. SUDAN: Community-based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity

Focal areas: Biodiversity and Climate Change
 # OP 1: Arid and semi-arid lands

(LAND DEGRADATION ADDRESSED IN THE BASELINE, INCREMENTAL COSTS FOR ADDITIONAL ACTIVITIES TO FACILITATE AND IMPROVE BIODIVERSITY CONSERVATION AND REDUCE NET EMISSIONS OF GREENHOUSE GASES)

A. PROJECT BACKGROUND

The project will help enhance biodiversity by rehabilitating rangelands and by preventing further land degradation. It will also reduce net emissions of GHGs by augmenting measures which would supplement a sustainable, local-level natural resource management system that stores and sequesters carbon. Specifically, the project builds upon community-based land use and range management master plans, revegetates environmentally sensitive areas, and tests several new techniques to rehabilitate rangeland.

B. INCREMENTAL COST ANALYSIS

1. Broad Development Goals

1.1 Land degradation is an immediate and urgent problem in Sudan and undermines the security and livelihoods of the people in the country. The government has broad action plans and initiatives in place which would address the immediate problems of food security, drought, animal and human health and to contain the high risks of failure of vegetable and fodder production.

1.2 The main development objectives of the country that are relevant to this project and context are as outlined in the Fourth UNDP Country Program (1993-96). This has three areas of concentration: (i) sustainable rural development (ii) promotion of food security, and (iii) strengthening of national capacity to manage development. These activities will be addressed through the baseline.

1.3 A major development problem is the lack of an overall national pastoral development policy. Also land tenure: proper long term management of natural resources by the local people cannot be expected unless they have secure communal rights to the land and resources.

2. Global Environmental Objectives

2.1 There are two main global environmental issues of interest here: biodiversity and climate change.

2.2 Land degradation reduces the area’ s biodiversity. The ecosystem of the project area, typical of other arid to semi-arid lands in the sub-Saharan belt, is potentially capable of supporting a wide range of species. Some of these species are known to be endangered or threatened, such as four species of gazelle (Dama, Dorcas, Rhim and Red-fronted), the Nubian Ibex, the Scimitar Oryx and the Barbary Sheep all have similar habitats. Certain plant species are especially threatened by continuous degradation. Special attention will be paid to propagating these species, primarily in range improvement and dune stabilization activities.

2.3 With continued land degradation, the land also loses its capacity to sequester and absorb carbon, an important factor in reducing the greenhouse effect.

3. Baseline

3.1 The priority problem in the project area, Bara Province in North Sudan, is the deterioration of rangelands by soil degradation, declining livestock and crop production. These problems can be attributed to:

a) a series of droughts which has had the effect of reducing the ecological capacity for production as well as regeneration;
b) an expansion of cultivation into rangelands which has resulted in a decrease in land available for grazing, and also cutoff livestock access routes;
c) a system of cultivation which leaves the land bear for up to nine months making it vulnerable to wind erosion;
d) an increase in the population; and
e) the traditional land tenure systems and social control over land use which has broken down, and which has not been replaced in any satisfactory form.

3.2 To ensure that these problems get addressed appropriately, a causal analysis of the situation is important. The conventional view that all land degradation is due to overgrazing is not quite accurate in this situation. A preliminary analysis of the situation revealed that: (i) drought has desiccated the environment and therefore reduced range productivity; (ii) livestock populations have dramatically dropped to below survival needs due to recurrent droughts; and (iii) land degradation is more due to deforestation, expanding cultivation and over-cultivation than to overgrazing.

3.3 Falling rangeland capacity has reduced (by death) the livestock by 80%. Agricultural expansion is in danger and potentially a greater problem because of the increasing in-migration of pastoralists in the north, and as population increases. Because of the immediacy of the problems associated with land degradation, specific action needs to be undertaken without further delay.

3.4 The issues of land degradation in this project are in the direct national interests of the country and should therefore be addressed though the baseline. This should target several of the people’ s immediate problems: water, animal and human health, and vegetable and fodder production. The value and urgency for land use planning and land tenure formalisation as a condition for land resource management cannot be under emphasized.

3.5 An action strategy needs to be designed to tackle these issues within the context of the national development plans and baseline. At present the following specific activities[4] should be pursued as part of the baseline. These include:

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[4] The list of activities which need to be taken under the baseline and alternative are not exhaustive in either case, merely illustrative of the ‘ types’ of action.

a) development of a national pastoral development policy and a national transhumance plans, and associated action to put these into effect;
b) to enhance the ability of local people to manage their natural resources at a sustainable level to prevent land degradation and to rehabilitate or improve rangelands;
c) to enhance ecological capacity for rangeland regeneration after drought and an initiation of the rehabilitation of a portion of the degraded areas through physical interventions and people' s participation;
d) diversification and improvement of the local production system through environmental education and introduction of technological innovations such as provision of wells etc., and
e) drought contingency measures.

3.6 The issue here is not just of enumerating what action (activity, policy or management) needs to be taken but whether the country is able to bear, or leverage, these costs. This point will be taken up again in Section 6.

4. The Proposed Alternative

4.1 The proposed alternative (in the GEF context) is for the rehabilitation of the desiccated environment to conserve biodiversity and to increase carbon sequestration. This will build upon the baseline activities. The management system will enhance biodiversity conservation by rehabilitating rangelands and by preventing further land degradation. The project will also help reduce global warming by augmenting the sustainable, local-level natural resource management system that stores and sequesters carbon.

4.2 There are specific activities which need to be taken to achieve the global environmental objectives, and will be dealt with accordingly.

4.3 **Biodiversity** : the project' s contribution to the preservation and improvement of the ecosystem will improve the habitat for endangered species and which will allow for their re-introduction into the area. Its central hypothesis is that community participation in rangeland management, coupled with secure land tenure and a favorable socio-political situation, will improve and provide for sustained range management and livestock production. Clearly such a plan will only work if the baseline is clearly in place and the proximate threats to people, their livelihoods and livestock are removed or controlled.

4.4 **Carbon sequestration** : this other primary output of the project will be achieved in two ways: the direct carbon storage associated with this pilot project and the indirect carbon storage resulting from replication of the project to neighboring areas. This will be achieved through the following activities/strategies:

- direct carbon sequestration (such as rangeland improvement, stabilization of land dunes and selection of appropriate vegetation type for wind breaks); and
- indirect carbon sequestration.

5. Scope of Analysis

5.1 The scope of the analysis includes all the significant changes caused by the decision to undertake the alternative strategy instead of the baseline, both within and beyond the project area.

In this case the direct impact of the actions associated with the proposed alternative are largely confined to the project area.

6. Costs and Incremental Cost Matrix

6.1 The incremental cost matrix is presented in Table 1, showing the main cost and benefit components associated with the baseline and alternative strategies.

6.2 With regard to the global benefit, shifting from the baseline to the alternative strategy will provide for improved probability of survival of some key endangered animal and plant species associated with the arid and semi-arid lands. The global climate change benefits would come from the facilitation of an improved sink function. The baseline domestic benefits will also benefit from the improved possibilities and long-term ecological rehabilitation of biodiversity of specific endangered livestock which has been an essential part of the heritage.

6.3 The complement of activities enumerated in the baseline constitutes the necessary actions which need to be taken by the country to counteract the basic threats to the livelihood of the people and livestock in the project area. The additional activities targeted specifically to alleviate the threats on the endangered biodiversity and to reduce the impact of climate change constitutes the alternative strategy. Only those costs which are different between the baseline and the alternative are shown.

6.4 The baseline activities and costs are estimated for the key programs which should be undertaken by the government. The assurance that the projects and activities associated with the baseline are in the pipeline (or underway) is very important because unless the most important of these threats are tackled, any move to introduce the alternative strategy is not likely to achieve the desired outcomes. The total cost of the baseline course of action is estimated at $ 2.23 million and is being financed by a wide range of sources which are described in the project document.

6.5 The first ‘ additional’ program of the alternative strategy focuses on strengthening biodiversity conservation in these rangelands, and is estimated to cost $ 0.2 million. The program will incorporate specific action for the endangered and threatened animal and plants species of these arid lands that have been almost been decimated through the onslaught of droughts and deforestation (for increased agricultural land). These species if rehabilitated to sufficient biological stock levels could be developed over the long-term for sustainable use (harvest) and management.

6.6 The second program of the alternative strategy centers upon the enhancement of the carbon sink in these rangelands, and is estimated to cost $ 45,000. This will be conducted through a series of pilot programs and projects.

6.7 The incremental capital costs for the alternative strategy would be $ 20,000 higher than for the baseline, while for each recurrent year (2 -10) the increment would be $ 205,000 more. The present value of pursuing the alternative strategy were estimated at $ 3.36 million, compared to the baseline of $ 2.28 million; giving an increment of $ 1.09 million.

6.8 The complementarity of the baseline and the alternative is of the essence. As mentioned above, the alternative strategy will include the actions of the baseline, but will be targeted to ensure that specific actions are taken to address the threats to the endangered biodiversity of the project area. However, unless the programs in the baseline are well executed, the alternative strategy will be ineffective.

7. Results

7.1 The issue of financing the project has to be innovative to deal with the special issues and challenges associated with land degradation and these issues will be discussed here.

7.2 This project is based on the assumption that long-term goals for natural resource management and the reduction of global warming can only be achieved through community-based actions that do not neglect the short-term survival and production needs of the community. Thus although the main thrust of the project from the GEF perspective is on biodiversity conservation and reducing the emission of greenhouse gases, the project may of necessity engage in a limited manner in range rehabilitation and management and drought contingency measures. The rationale for this follows.

7.3 As mentioned above the question which arises here is: to what extent is the country able to bear the costs of the baseline, or leverage financing for it? And more importantly from the GEF perspective, the question is whether the baseline activities have to be in place before the GEF alternative comes into action. If that is the case then how long will it be possible to delay the GEF input without jeopardizing the 'biodiversity loss' further[5]. Or is it the case that it is best for the GEF project to be effected immediately, and simultaneously, with the baseline to achieve the desired outcomes. In this latter case the costs of the baseline activities may be shared, because they provide both domestic and global benefits.

7.4 In this context the more assistance the country has in enabling them to get off the ground, through the removal of barriers (especially for those activities which have 'joint' [6] domestic and global benefits, and which would in the GEF context hasten the onset of the GEF objectives) the higher the likelihood of success of the overall project. Furthermore, the incidental domestic benefits of the 'alternative strategy' could improve the baseline situation by a magnitude which the country could certainly not factor in if left to its own resource or priorities (benefit sharing vs cost sharing).

7.5 These issues hold true in a generic sense but are more pertinent and relevant in the context of land degradation. This is because of the nature of land degradation problems: they are more far reaching, more closely linked to poverty, food security etc. and the risks (e.g. drought, desertification etc.) associated with them are higher, both in the national and global perspectives. The ultimate aim of the project (in the GEF context) is to encourage local people to commit to the communal management of their land and resource base in ways that reduce global warming and increase biodiversity. At the same time the project aims to reduce day-to-day uncertainty.

7.6 The GEF project could, under the alternative, seek to fund additionally those activities which provide for these 'joint' benefits e.g. rangeland management and rehabilitation and drought contingency plans (indicated as italics in Table 1).

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[5] The situation with regard to climate change is not site specific, and would not be affected by time dimension with regard to this particular project.

[6] It is important to make a distinction here between 'joint' benefits and 'incidental' benefits, where the latter are largely to one party, but accidentally provide benefits to the second party.

Table 1 : Incremental Cost Matrix for Sudan

	Baseline (B) **(to address land degradation issues)**	**Alternative (A)** **(to adapt & modify baseline activities for BD & CC)**	**Increment (A-B)**
Global Biodiversity Benefits	• the unique & endangered arid & semi-arid species would continue to decline in numbers as issues of food security etc. need to be addressed	• ensure conservation of unique & endangered arid & semi-arid species	• improved conservation of specific plant & animal species
Global Climate Change Benefits	• no special efforts to enhance the carbon sink function	• enhance the carbon sink function	• improved carbon sink function and reduction in GHGs
Domestic Benefits	• business-as-usual	• improved possibilities and hastening of rehabilitation of the natural systems	• > 0
Activities/Costs: **Capital costs (year 1)**	• national pastoral development policy ($ 60,000) • development of a national transhumance master plan ($ 60,000) • land tenure and customary land use and management ($ 100,000) • *drought contingency plans* ($ 40,000)	• national pastoral development policy ($ 70,000) • development of a national transhumance master plan ($ 70,000) • land tenure and customary land use and management ($ 100,000) • *drought contingency plans* ($ 40,000)	• ($ 10,000) • ($ 10,000) • ($ 0) • ($ 0) **($ 20,000)**

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	Baseline (B) (to address land degradation issues)	Alternative (A) (to adapt & modify baseline activities for BD & CC)	Increment (A-B)
Recurrent costs (year 2-10)	• *rangeland rehabilitation & mgmt.* ($ 100,000) • irrigated fodder production ($ 30,000) • water development ($ 150,000) • creation of wind breaks ($ 70,000)	• *rangeland rehabilitation & mgmt.* • improving habitat or project area for endangered species re-introduction of endangered species (BD) ($ 200,000) • irrigated fodder production ($ 30,000) • water development ($ 150,000) • creation of wind breaks • selection of vegetation spp. for windbreaks to enhance long-term carbon storage (BD, CC) ($ 70,000) ($ 45,000) • incorporation of traditional knowledge into management ($ 20,000) • development of viable, replicable techniques ($ 20,000) (items in italics will be partially supported though the alternative (see text))	• ($ 100,000) • ($ 0) • ($ 0) • ($ 45,000) • ($ 20,000) • ($ 20,000) **($ 185,000)**
PV incremental costs (10% d.r., 10 years)	$ 2.28 million	$ 3.36 million	$ 1.09 million

Notes:
1. The costs are for illustrative purposes only, and do not reflect actual costs in the project.
2. Activities in italics represent those which provide ' joint benefits' (see text).

PARADIGM CASE ON INCREMENTAL COSTS

C. MEXICO: Enhancing Carbon Storage of Degraded Land Through Planting of Halophytes: Comparison of Transitional vs Long-term Carbon Strategies

Focal areas: Biodiversity and Climate Change
 # OP 1: Arid and semi-arid lands

(LAND DEGRADATION ADDRESSED IN BASELINE, INCREMENTAL COSTS FOR TRANSITIONAL VS LONG-TERM CARBON STORAGE STRATEGIES)

A. PROJECT BACKGROUND

This project illustrates the use of non-forest biomass production to contain land degradation, and its concurrent benefit as a carbon sink in Sonoran, Mexico. The non-forest biomass could be planted as either a transitional (short-term) strategy or a long-term carbon strategy: the project explores the incremental cost assessment and other implications of doing so.

B. INCREMENTAL COST ANALYSIS

1. Broad Development Goals

1.1 The broad development goal of the country with regard to land resources is to arrest and contain the spread of land degradation, and to rehabilitate and reclaim the degraded land through the most cost-effective means available.

2. Global Environmental Benefits

2.1 Halophytes are salt-tolerant terrestrial plants (e.g. *Atriplex*, *Saliconia* and *Indica)*. They represent an important non-forest biomass which can be used for the reduction of atmospheric levels of carbon dioxide. This is especially cost-effective where it does not compete with arable land, and hence does not incur opportunity costs in terms of alternative land use.

2.2 There are several species of halophytes, and each of these species has specific properties, for example *Atriplex* spp. and *Haloxylon aphullum* may be used for soil stabilization while the S*alicornia* spp. can be irrigated with sea water and - in the case of *salicornia bigelovii*, it is ideally suited for cultivation in desert or near-desert coastal regions. Its potential for removal and storage of salt and heavy metals from waste water and for reducing the salinity of drainage water in large scale irrigation schemes are all added benefits.

2.3 Halophytes also provide raw materials for many types of industries and have the potential to be developed into agro-industrial products, thus creating more jobs at the domestic front. Parts of the plant can be used as:

- a farming product: cooking oil and " sea asparagus"
- biomass for power generation

- oil-additive fuel for combustion engines
- fiber-based material for particle board manufacturing
- seeds (42% protein) can serve as supplement to livestock feed.

2.4 Its characteristics and the wide range of local benefits it provides makes halophytes a potentially interesting crop for desert coastal development and revitalization of salinised desert areas around the world. Halophytes can be produced on non-arable and on offshore sites, where they do not compete with agriculture.

2.5 The precise level of global benefits would depend on the proportion of biomass stored versus released, and this would need to be addressed through the project design. Land reclamation and restoration with halophytes can have both domestic and global benefits depending on the fate of the biomass produced. Removing CO_2 from the atmosphere requires the use of biomass with a long carbon storage lifetime, such as wood, peat or biomass deposited in deep-sea or wet sediments. The CO_2 incorporated into biomass for food and fodder has a residence time of only one to two years and is of less value for atmospheric CO_2 reduction. However, growing halophytes for food and fodder could make an indirect contribution to atmospheric carbon mitigation by reducing the need for deforestation for fuel wood or to create new cropland. Therefore in the context of global benefits halophyte biomass must either be stabilized for long-term storage or used as a replacement for fossil fuels to make more substantive and direct contributions to removing CO_2 from the atmosphere.

2.6 A total of 1.13 million km^2 of coastal desert and inland saline land worldwide have been identified by scientists as suitable for growing halophytes. The areas recommended to be planted with halophytes comply with some basic criteria, including: (i) flat topography below 100 m; (ii) presently unused for agriculture; and (iii) very low natural primary production. The total coastal desert land available for sea water irrigation of halophytes represents 494,000 km^2 and the inland salt desert suitable for brackish water irrigation is 635,000 km^2. It is estimated that this total additional land will be sufficient to sequester a stock of carbon equivalent to 10% of annual carbon emissions (i.e., about 700 million tons of carbon).

3. Baseline

3.1 In the State of Sonoran in Mexico, freshwater is scarce. Most of the regional agriculture that has developed over the last 30 to 50 years has depleted groundwater and led to sea water intrusion into deep wells. These barren, abandoned, saline soils can lead to increased land degradation through deposition of salt in adjacent areas resulting in further loss in soil productivity.

3.2 Since then the Government of Mexico has closed many wells and relocated segments of the agriculturally dependent population, providing new irrigation sources at a cost of about US$10,000 per ha. Although this solves the problem in the short-run, it is an expensive option and not sustainable over the longer term, and does not contain the spread of land degradation. This is the current, business-as-usual baseline (B).

3.3 The coastal Sonoran Desert in Mexico has been identified as suitable for halophytes through a series of test plots. The planting of these areas with halophytes would provide local environmental benefits through land reclamation. Specifically, it would overcome and contain land degradation. The primary purpose of planting halophytes would be to reduce salt levels in the salt-affected lands so that native ecosystems (and agricultural crops) could subsequently be re-established. Meanwhile, the halophytes can also be harvested for food and fodder. An added benefit of this approach is that it would reduce the need for deforestation of land to create new cropland. This would be seen as the sustainble baseline (SB) option for the project area under consideration: it uses the halophytes as a transitional strategy: i.e. as biological desalinizers.

3.4 In planting halophytes, the use of native species is recommended to discourage species introductions which may have potentially devastating effects on the community dynamics of native species. While rapidly spreading species may be economical in that they reduce establishment costs, they may spread to areas where they are undesirable, and thus incur costly eradication efforts afterwards.

4. The Proposed Alternative(s)

4.1 The specific project intervention being considered here seeks to provide global environmental benefits by increasing the carbon sink function of the halophytes.

4.2 There are two alternative strategies which will be addressed here. The first alternative (A1) would seek to modify the transitional sustainable baseline (SB) strategy so as to improve the carbon storage value of the halophytes. This would be achieved primarily through the ' plowing under of halophytes' : an activity which improves carbon storage. This additional activity incurs an incremental cost to the country, since there are no national benefits of doing so. As in the case of the sustainable baseline, the halophytes under this alternative (A1) would be used primarily for food and fodder.

4.3 For maximizing carbon function, the carbon must be stabilized for long-term storage. This takes us to the second alternative (A2). In this case, the halophytes are grown as biomass crops for the sole purpose of carbon sequestration, and not as a transitional strategy for subsequent re-establishment with agricultural crops. For the A2 strategy to be viable and to ensure the long-term carbon storage criteria, the halophytes harvested must be utilized. As mentioned above the potential for the halophytes to be developed into agro-industrial products (e.g. as replacement for fossil fuels) would make a direct contribution to removing CO_2 from the atmosphere. The country, however, is not as yet in the position to proceed into this agro-industrial phase because it lacks the necessary technical expertise, infrastructure and equipment to do so. The costs associated with setting up this must be provided for under the A2 strategy.

4.4 Each of these alternatives (A1 or A2) has very different impacts on the level of carbon sequestered. Similarly, cost allocation would depend on whether the halophytes are planted as a transitional strategy, or as a long-term crop. In the A1 alternative, the national benefit is for rehabilitation of agricultural land, and the incremental costs are associated with the need for one major additional activity e.g. plowing under of halophytes. In the second alternative the incremental costs are associated with providing technical expertise and the capital costs towards setting up the agro-industry, until it is self-sustaining.

5. Scope of Analysis

5.1 Depending on the alternative chosen and the extent of land over which the halophytes are planted they could provide some cost-savings which should be taken into consideration. Two key savings to the country include: (i) the creation of a domestic source of oilseeds which would mean reduced imports to meet the domestic demand, and (ii) creation of new job opportunities.

6. Costs

6.1 We have four situations which are being costed: the baseline which is an extension of the business-as-usual, the sustainable baseline which is a transitional strategy, and the two alternatives, A1 and A2. The incremental cost matrix for Sonoran is shown in Table 1. One needs to compile the costs of the various components listed and arrange them in a format suggested in Table 1.

6.2 The main cost and benefit components associated with each situation is presented. With regard to global benefits, shifting from the sustainable baseline to Alternative 1 provides for improved short-term carbon storage under the transitional strategy of halophytes, while a shift to Alternative 2 would provide for a more stable carbon sink because of the long-term storage associated with the halophytes planted.

6.3 The baseline domestic benefits in shifting from the baseline to the sustainable baseline includes the arresting of land degradation as well as restoration of land, plus the provision of specific food and fodder products associated with halophytes. These benefits are retained under A1, while a shift to A2 would provide new agro-industrial products and related job opportunities.

6.4 The costs associated with halophyte production are estimated as capital and operating costs. Currently, under the baseline the government incurs costs of $ 10,000/ha to provide new irrigation sources to the populations re-located out of the degraded areas. We use this as the conservative estimate of total costs incurred under the baseline. These costs will be incurred under the three remaining situations i.e. for SB, A1 and A2, but only for the first three years, until the halophytes provide some returns, especially as food and fodder.

6.5 In shifting from the current situation to the sustainable baseline, the main cost of setting up halophyte farms include: initial preparation of land, seeding, irrigating, harvesting and replanting. The halophytes are harvested at the end of 5 years and then again at the end of the 10th year, after which it is assumed that the land will be ready for the re-planting of agricultural crops. Also associated with the sustainable baseline are some cost savings which will accrue to the country. These should be taken into account. Those included in the matrix are for cost savings due to reduced import of oilseeds for domestic needs which will be provided by the halophyte seeds, and for creation of employment (3-7 jobs per 10 ha).

6.6 The costings for first alternative (A1) are fairly similar to the sustainable baseline (SB), except for one major additional activity (e.g. plowing under of halophytes) to facilitate improved carbon storage.

6.7 Under Alternative 2 the initial cost of planting of halophytes is similar to A1, but with additional capital costs up-front towards the establishment of this agro-industry. These costs, estimated at about $ 5,000/ha, would be incurred for the first five years, and for the next five years there are running costs of $ 2,000/ha; after which it is anticipated that the industry should take off and be financially sustainable.

6.8 The present value of the cost savings calculated for the domestic supply of oil seeds and job creation opportunities were estimated at $ 3,288/ha for SB and A1 and $ 4,862/ha for A2.

6.9 Table 1 has the summary of the results. The present value of the current business-as-usual baseline for the 10 year project period, calculated at $ 67,590/ha; whilst that for the SB and A1 is estimated at $ 66,168/ha and $ 70,792/ha. The costs for the second alternative A2 were estimated at $ 95,804. The cost savings have been subtracted for each situation.

7. Results

7.1 Table 1 presents the costs of the various components associated with each of the scenarios investigated; as well as the increment associated in moving from one scenario to the next. The results provide interesting insights.

7.2 The results indicate that the current baseline (i.e. the business-as-usual) is in-fact a more expensive option than that of shifting to the sustainable baseline, which is the transitional strategy of planting halophytes as biological desalinisers. The incremental costs of doing so are negative i.e. to say that the government would actually accrue a saving of $ 1,423/ha under the SB option. The country should therefore definitely more to the SB scenario.

7.3 To accrue the global benefits: the incremental costs associated in shifting from SB to A1 are $ 4,624/ha, whilst that of shifting directly from SB to A2 are considerably higher at $ 29,637/ha - but the latter would secure longer term storage.

8. Issues, Actions, and Risks

8.1 There are two potential risks associated with the project which should be monitored closely: (i) physical disturbances associated with planting of halophytes, particularly with large-scale irrigation using sea water, could lead to a change in ecosystem functions such as hydrological cycling, nutrient cycling and other soil processes, and (ii) the long-term effects of continuous irrigation of halophyte crops with saline water are not well understood. The most efficient irrigation systems would require enough water to equal the evapotranspiration rate (net percolation = 0), plus a leaching fraction sufficient to remove accumulated salts from the soil surface, to prevent inhibition of plant growth. These effects should be monitored.

Key reference used:

van Orsdol, K.G., Girsback, I.G. & Armstrong, J.K. (1993) Greenhouse Gas Abatement through Non-forest Biomass Production: Allocating Costs to Global and Domestic Objectives. Environment Dept Working Pp. No. 59, World Bank

Table 1: Incremental Cost Matrix for Mexico

	Baseline (B) (business-as-usual)	Sustainable baseline (SB) (halophytes as transitional strategy)	Alternative 1 (A1) (halophytes as transitional strategy)	Alternative 2 (A2) (halophytes as long-term strategy)	(SB - B): traditional dev. asst.	Increment 1= (A1 - SB): GEF asst.	Increment 2 = (A2 - SB): GEF asst.
Global Environmental Benefits	• no carbon sequestration	• carbon sequestered	• improved carbon sequestration	• long term carbon sequestration	• carbon sink	• more complete carbon sink	• long-term carbon sink
Domestic Benefits	• land remains degraded, and continues to degrade	• degradation arrested and land reclaimed • halophyte available as food and fodder • reduced import of oil seeds • job creation	• degradation arrested and land reclaimed • halophyte available as food and fodder • reduced import of oil seeds • job creation	• creation of new agro-industries and associated jobs	• > 0	• > 0	• > 0
Annual Costs Capital ($/ha) (yr 1/yr 6 for SB & A1, and yr 1 for A2)		(2 cycles of halophyte crop) • land clearing ($ 67; yr 1,6) • construction of drainage system ($ 1500; yr 1) • planting ($ 1296; yr 1,6)	(2 cycles of halophyte crop) • land clearing ($ 67; yr 1,6) • construction of drainage system ($ 1500; yr 1) • planting ($ 1296; yr 1,6)	(2 cycles of halophyte crop) • land clearing ($ 67; yr 1,6) • construction of drainage system ($ 1500; yr 1) • planting ($ 1296; yr 1,6) • agro-industry set-up ($ 5000; yr 1-5)			

cont' d..

	Baseline (B) (business-as-usual)	Sustainable baseline (SB) (halophytes as transitional strategy)	Alternative 1 (A1) (halophytes as transitional strategy)	Alternative 2 (A2) (halophytes as long-term strategy)	(SB - B): traditional dev. asst.	Increment 1= (A1 - SB): GEF asst.	Increment 2 = (A2 - SB): GEF asst.
Operating ($/ha) (yr 2-5 & yr 6-10 for A1 and yr 2-10 for A2)	• provision of new irrigation sources (yr 1-10)	• operation of drainage system ($ 300; yr 2-10) • watering/ irrigation ($ 5251; yr 2-10) • maintenance/ fertilizer ($ 296; yr 2-10) • harvesting ($ 100) (yr 5,10) • other ($ 800; yr 2-10) • provision of new irrigation sources ($ 10,000/ha; yr 1-3)	• operation of drainage system ($ 300; yr 2-10) • watering/ irrigation ($ 5251; yr 2-10) • maintenance/ fertilizer ($ 296; yr 2-10) • harvesting ($ 100) (yr 5,10) • plowing biomass ($ 900 yr 2-10) • other ($ 800; yr 2-10) • provision of new irrigation sources ($ 10,000/ha; yr 1-3)	• operation of drainage system ($ 300; yr 2-10) • watering/ irrigation ($ 5251; yr 2-10) • maintenance/ fertilizer ($ 296; yr 2-10) • harvesting ($ 100) (yr 5,10) • plowing biomass ($ 900 yr 2-10) • other ($ 800; yr 2-10) • running costs of agro-industry ($ 2000 yr 6 -10) • provision of new irrigation sources ($ 10,000/ha; yr 1-3)			
PV of costs/ha (10% d.r., 10 yr)	**$ 67,590**	**$ 69,456/ha**	**$ 74,080/ha**	**$ 100,066/ha**	**$ 1,865/ha**	**$ 4,624/ha**	**$ 31,211/ha**

	Baseline (B) (business-as-usual)	Sustainable baseline (SB) (halophytes as transitional strategy)	Alternative 1 (A1) (halophytes as transitional strategy)	Alternative 2 (A2) (halophytes as long-term strategy)	(SB - B): traditional dev. asst.	Increment 1= (A1 - SB): GEF asst.	Increment 2 = (A2 - SB): GEF asst.
Cost savings		• Reduced import of oilseeds ($ X/ha) = $500/ha (yr 6 - 10) • job creation ($ Y/ha) = 0.5 job/ha @ $ 400/year (yr 1-10)	• Reduced import of oilseeds ($ X/ha) = $500/ha (yr 6 - 10) • job creation ($ Y/ha) = 0.5 job/ha @ $ 400/year (yr 1-10)	• Reduced import of oilseeds ($ X/ha) = $500/ha (yr 6 - 10) • job creation ($ Y/ha) = 0.5 job/ha @ $ 400/yr (yr 1-5) • job creation increased to three times @ $ 1200/yr (yr 6-10)			
PV of cost savings	$ 0/ha	$ 3,288/ha	$ 3,288/ha	$ 4,862/ha			
Net PV costs	$ 67,590/ha	$ 66,168/ha	$ 70,792ha	$ 95,804/ha	- $ 1,423/ha	$ 4,626/ha	$ 29,637/ha

D. KAZAKSTAN: Adaptation To Climate Change - Link With Land Degradation

(This is not a full paradigm case, but a generic representation.)

Focal areas: Climate Change

 # OP 1: Arid and semi-arid lands

(LAND DEGRADATION ADDRESSED IN BASELINE, INCREMENTAL COSTS FOR ADDITIONAL LAND DEGRADATION COSTS IMPOSED THROUGH CLIMATE CHANGE)

Land degradation : Land degradation is brought about by a complex set of factors, which could be operating at the community, local, national and regional levels. These often threaten the very fabric of the sustainability of livelihoods of the population in a country. Accordingly these threats of land degradation have to be addressed through the baseline. This can be effected through a series of reactive and anticipatory actions/activities to contain and improve the situation over time, and these baseline costs should be met by the country or through traditional developmental assistance.

Climate change impacts on land degradation : Land degradation may be exacerbated by the impact of the large-scale changes in climate due to the greenhouse effect. Patterns of rain, drought and variability in temperature could become more extreme, and as a consequence increase the pace or extent of land degradation. In order to respond optimally to land degradation, countries may have to spend more as a result of the need to adapt to climate change than they would have spent, had climate remained stable.

Background : In the 1930s, the Soviet Union initiated a "Virgin Lands" program to expand the land under cultivation. Much of this land, including land in Kazakstan, was only marginally suitable and as a result has been significantly degraded. It is now recognized that it is in the national interest to address this soil erosion (see below). The land degradation, serious as it is even in the present climate, would be exacerbated by the increased precipitation expected in the affected regions as a result of climate change. Climate change, in other words would impose an additional cost on Kazakstan. In preliminary studies to identify possible adaptation activities, soil protection measures were ranked as a high priority. The extent to which the costs of appropriate measures are increased by the need to adapt to climate change would be incremental.

Preliminary analysis: Certain 'Screening and Decision Matrices' were used to identify, evaluate and rank climate change adaptation measures for agriculture and water resources based on their effectiveness in meeting policy goals under climate change and their relative costs. The most plausible climate change scenarios were investigated against the need for agricultural adaptation responses and options to reduce vulnerability to water supply reductions. The climate change scenarios explored here include:

- + 3^{o}C, no change in precipitation (dry scenario)
- + 2^{o}C, and + 20% change in precipitation (wet scenario).

The preliminary results, and of interest in the current context, indicate that in adapting to climate change impacts, high(est) priority should be accorded to the reduction of soil erosion. Climate change would exacerbate soil erosion.

Strategy to address soil erosion: Specific activities to contain soil erosion include:

- improved terracing and use of silt traps
- use of organic fertilizer to reduce off-site impacts of soil erosion
- planting of wind-breaks to stabilize soil and reduce soil erosion by wind
- increased irrigation to provide for the wind-break vegetation to be stabilized effectively

Scenario	**Cost of protecting soil**
Stable climate	$ X
Climate change	$ Y
Cost imposed by climate change	$ (Y -X)

PARADIGM CASE ON INCREMENTAL COSTS

E. SENEGAL AND MAURITANIA: Assessment Of Incremental Costs For A Multi-Focal Area That Builds On Land Degradation And Rehabilitation Efforts

(This is not a full paradigm case; but an illustration of how a project in its early formative stages should be scrutinized and analyzed strategically for GEF intervention)

Focal areas: Biodiversity, Climate Change and International Waters
 # OP 1: Arid and semi-arid lands

(LAND DEGRADATION ADDRESSED IN BASELINE, INCREMENTAL COSTS FOR CONTAINING BIODIVERSITY LOSS, CLIMATE CHANGE MEASURES AND ADDRESSING AREAWIDE TRANSBOUNDARY WATER CONCERNS)

Problems: unsustainable harvests, destruction of biomass, forest clearance, loss of biodiversity, bushfires, change in water-flow in Senegal river, advance of sand-dunes, destruction of river-banks, over-grazing, extinction of species, land degradation, desertification, drought etc.

Proposed measures:

- dam: to steady water supply
- agricultural development
- development of forests:
- environmental training and management

Questions to be addressed

Q1. Will the proposed baseline measures or interventions contain the spread of desertification and land degradation? If no, what else needs to be done to ensure that the baseline is sustainable?

Q2. Will these measures, and added measures, also address global environmental concerns as asserted through the four focal areas? or will they in any way undermine them?

Q3. Which focal areas do the activities (or lack of them) impinge or interact with global environmental concerns?

Q4. How can the sustainable baseline activities be **modified** or **adapted** further to address these global environmental concerns?

Approach

Two step approach:

- From current (business-as-usual) situation to sustainable baseline: national interests
- From sustainable baseline to alternative: global interests

Incremental cost assessment: see table which follows for an illustrative matrix.

Table 1: Incremental Cost Matrix for Senegal and Mauritania (illustrative)

	Current situation	Sustainable baseline (B)	Alternative (A)	Increment : (A - B)
Global Environmental Benefits	• loss of carbon sinks, increase carbon release (CC) • no systematic management of international waters (IW) • loss of biodiversity resources (BD)	• carbon release controlled, some increase in carbon sinks (CC) • river waters managed and abstracted for use (IW)	• carbon sinks increased & maintained (CC) • international waters managed on an areawide basis (IW) • biodiversity restored and conserved & managed for sustainable use (BD)	• more secure global environmental benefits (BD , CC and IW)
Domestic Benefits	• land remains degraded, desertification extent increases	• desertification arrested and land degradation addressed	• desertification arrested and land degradation addressed • more diverse resource supply	• >0
Activities/Costs	• (over) harvest of forests, resources • (over) grazing • (reduced) agriculture	• dam constructed to regulate & exploit water resources • drought contingency plans • agricultural development • integrated forest mgmt. • re-forestation	• to facilitate co- odn. and improved water mgmt. on an areawide basis between the three countries (IW) • agricultural development complemented with biodiversity conservation aimed at enabling sustainable use of its components (BD) • training etc. for improved long-term forest mgmt. with considerations for biodiversity conservation & carbon sequestration (CC, BD) • re-forestation combined with alternative energy conservation (BD, CC)	

		• **improved pastoral & rangeland mgmt.** • **wind-breaks planted** • **soil conservation measures effected** • **policies for natural resource mgmt.** • **environment training and mgmt for community members**	• **additional features to rangeland mgmt. to attract wildlife back, and to serve as transhumance sites/pathways (BD)** • **conservation programs for re-introduction & mgmt. of endangered species (BD)** • **wind-breaks: selection of species which are hardy, provide long-term carbon storage (CC)** • **soil conservation measures enhanced to improve below ground carbon sinks (CC)** • **incorporation of traditional knowledge into [policies being formulated**	
TOTAL COSTS	**$ X**	**$ Y**	**$ Z**	**$(Z-Y)**

Notes:

1. The current situation is not sustainable. Activities under the sustainable baseline go beyond those outlined in Box 1.
2. The incremental cost in shifting from the current situation to the sustainable baseline $ (Y-X): are in the national interests and should be financed nationally or through traditional development assistance.
3. The increment for accruing global environmental benefits $ (Z-Y) could be supported by the GEF.

PARADIGM CASE ON INCREMENTAL COSTS

F. KENYA, UGANDA AND TANZANIA: Lake Victoria Environmental Management Project

Focal areas: International Waters and Biodiversity
 # OP : Waterbody-based

(LAND DEGRADATION ADDRESSED IN THE BASELINE, INCREMENTAL COSTS FOR BIODIVERSITY CONSERVATION AND FOR THE ASSURANCE OF AREAWIDE WATER CONCERNS)

A. PROJECT BACKGROUND

The project will be the first program to address the major environmental threats to the Lake Victoria ecosystem, all of which are transboundary in nature. The project will develop the information, capacity and institutions need for collective action, and test through a number of targeted pilot actions and investments, the feasibility and initial impact of some of the priority regional initiatives needed to stabilize the lake ecosystem. Each project involves significant transaction and regional capacity-building costs first to establish cooperative agreements, and second to implement priority elements of them on a trial basis. These costs are clearly incremental in that they are not in the national baselines, would not be incurred without the project, and address transboundary environmental issues.

GEF will act as a *catalyst* for the three countries to develop a better understanding of how the lake functions, learn how the actions of their populations in the lake basin affect the lake environment, and work out ways jointly with one another to implement a comprehensive approach to managing the lake ecosystem to achieve global benefits. The emphasis on GEF' s role as a catalyst means that a fair amount of the responsibility for concerted action must lie with the countries.

B. INCREMENTAL COST ANALYSIS

1. Broad Development Goals

1.1 Lake Victoria reaches a maximum depth of about 80m, and an average depth of about 40m. The lake' s shoreline is long (about 3,500 km) and convoluted, enclosing innumerable small, shallow bays and inlets. Some 85% of the water is from precipitation, and 7% from the river Kagera, which is the most significant of the rivers. Some 85% of the water is lost through direct evaporation, and remaining 15% through the Victoria Nile.

1.2 There are three countries that share jurisdiction over Lake Victoria, namely, Kenya, Uganda and Tanzania. Each of the three riparian governments has prepared a National Environmental Action Plan (NEAP). All three NEAPs acknowledge that Lake Victoria demands urgent attention through regional cooperation. The NEAPs focus on problems such as water pollution, biodiversity loss, land degradation, deforestation, and damage to wetlands, all central concerns for the lake and its catchments. Scientists and regional managers have increasingly warned that the absence of a regional management framework may threaten the future viability of the lake basin.

1.3 Discussions to broaden regional co-operation covering the Lake Victoria Basin started in late 1992. In May 1994 the three governments decided to enter into an agreement jointly to prepare and implement a Lake Victoria Environment Management Program. A Tripartite agreement to this effect was signed August 5th, 1994.

1.4 The Tripartite Agreement, as enhanced by the government preparation report, constitutes a framework for action fully responsive to the requirement for a Strategic Action Plan (SAP). This SAP, whose preparation included extensive stakeholder consultation, was reviewed thoroughly during appraisal. It identifies, acknowledges and analyzes the transboundary water-related environmental concerns which the three governments share in common. Furthermore, it expresses their determination jointly to build the capacity of existing institutions, and establishes new ones, in order that they may adopt a comprehensive approach to addressing the shared transboundary concerns, and implement measures to deal with the priority concerns as identified, with a particular focus on community stakeholder involvement and measures to raise public awareness.

1.5 The essential soundness of this agreement has been proven during the preparation of this project - Lake Victoria Environmental Management Program (LVEMP) - and its main institutional arrangements, which have worked well, should continue into project implementation.

2. Global Environmental Objectives

2.1 Lake Victoria is an international water body that is both of great economic worth to the three riparian countries and of great scientific and cultural significance to the global community. The lake's origins are of scientific dispute and interests in view of the 'recent' upthrust of the western side of the basin, which caused Lake Victoria to form by flowing eastwards. It is possible that the lake could have formed as recently as 25,000 to 35,000 years ago, and recent evidence suggests it may have dried up completely between 10,000 and 14,000 years ago.

2.2 It is one of the largest freshwater habitats in the world, and has unique waterborne diversity. Although there are many features of Lake Victoria which are of interest to biologists, it is fish that receive the most attention. Most of the fish species now in the lake also lived in the preceding west-flowing rivers, but the *cichlids*, in particular, had a remarkable burst of speciation in response to the change from river to lake conditions. There are more than 200 endemic species and 4 endemic genera of cichlids in Lake Victoria, more than 150 species of which are of the genus *Haplochromis*. Another major lineage is the tilapines. The non-cichlid fishes have also changed, and there are at least 50 species, of which 29 are endemic, and one endemic genus.

2.3 One of the main objectives of the LVEMP, from the global perspective, is the preservation of the existing richness of the haplochromid fish fauna for scientific purposes, and its role in providing resilience to the lake ecosystem.

2.4 Lake Victoria is a "commons" of water, biota, nutrients, pollutants, and the human activities which use the resources of the lake and its catchments, and impact upon them. Lake Victoria is suffering severely from three of the four major global environmental concerns highlighted in the GEF Operational Strategy for international waters: degradation of water quality due to pollution from land-based activities, introduction of non-indigenous species, excessive exploitation of living resources. Several of these threats are transboundary in nature, and as such the need for concerted action, or action to facilitate the protection of this "commons" is urgent.

2.5 The project is consistent with the following operational programs:

- water-based body
- integrated land and water
- contaminant based
- biodiversity (in freshwater systems).

3. Baseline

3.1 Lake Victoria basin is used as a source of food, energy, drinking and irrigation water, shelter, transport and as a repository for human, agricultural and industrial waste. At the moment the lake is being overburdened by the activities of the three riparian countries that share the lake.

3.2 Continuation of current practices on the riparian fringes and beyond will have implications on the health of the lake ecosystem. These practices have also resulted in: (a) a decline in the overall fishery as a result of both overfishing and deterioration of lake water quality; (b) increasing extent and severity of water hyacinth infestation; (c) unsuitability of the lake water for domestic supply or animal watering; and (d) continued degradation of the wetlands. The basin is also facing their typical consequences - potentially irreversible environmental damage, hardship to the poor and serious health concerns. One of the most pressing concerns is a possible decline in the very valuable fishery (currently worth US$ 320 million annually in export revenue), but this predicted decline represents merely an immediately obvious outcome of the loss of resilience of the ecosystem.

3.3 A large number of donors have supported a vast range of development initiatives in and around Lake Victoria. Some of these have addressed priority environmental concerns, but mostly in small, uncoordinated, and incomplete ways, and seldom with informed intentionality which had the wider environmental priorities in mind. In the absence of a coordinated management and information system for the entire lake and its ecosystem, these smaller projects have often fallen short, and continue to fall short, of realizing their maximum potential. Although often successful in their own terms, they could have achieved even more by being part of a coordinated management initiatives to address the lake ecosystem and its problems. The reason for this is that although the problems are created within the nations, they have transboundary impacts. There is a need for concerted, corrective action to be pursued which is beyond national interests, but of regional and global importance.

3.4 With poverty endemic to the region and many competing claims for scarce development resources, the need for a strategy and financial support to overcome the barriers to concerted corrective action is extremely strong, because each individual country does not have the means to do so.

3.5 The current project is such a management initiative, which will lead to a quantum leap in understanding the ecosystem, and in devising sustainable management strategies.

4. The Proposed Alternative

4.1 The alternative proposed here will complement national initiatives, but will go a step further to address the major environmental threats to the Lake Victoria ecosystem, all of which are transboundary in nature.

4.2 The Lake Victoria Environment Management Project (LVEMP) is a comprehensive program aimed at rehabilitation of the lake ecosystem for the benefit of the people who live in the catchment, the national economies of which they are a part of, and the global community. The main program objectives are: (a) to maximize the sustainable benefits to riparian communities from using resources within the basin to generate food, employment and income, supply safe water, and sustain a disease-free environment; and (b) conserve biodiversity and genetic resources for the benefit of the global community. Although it may appear that it is objective (b) which is of GEF's interest, whilst (a) is of national interests, there is in fact an integral link between the activities which have to be taken as part of the national and global programs to meet the national and global objectives, respectively.

4.3 The GEF assistance will act as a catalyst for the three countries to develop a better understanding of how the lake functions, learn how the actions of their populations in the lake basin affect the lake environment (through targeted research), and work out ways jointly with one another to implement a comprehensive approach to managing the lake ecosystem to achieve global environmental benefits.

4.4 Specifically, the project will lay foundations - of knowledge, capacity, and cooperative institutional frameworks - for a long term program of investments in the lake and its catchments, which will rehabilitate and stabilize the ecosystem. For example, if the long-standing barriers to regional fisheries cooperation can be overcome, the design and implementation of a regional fisheries management program will eventually contribute to a more sustainable fish catch, as well as conservation of the lake's aquatic biodiversity. The costs of overcoming these barriers are therefore truly incremental. So too are the costs of actions to achieve additional global benefits, such as aquaculture in support of endangered species, and conservation of critical habitats

4.5 Each component of the project will involve significant transaction and regional capacity-building costs first to establish cooperative agreements, and second to implement priority elements of them on a trial basis. These costs are clearly incremental in that they are not in the national baselines, would not be incurred without the project, and address transboundary environmental issues. The regional benefits of the project would be the incremental avoidance or reduction of damage costs associated with these consequences, beyond the damage avoided as a result of actions that would have been taken to achieve local benefits.

4.6 GEF funding for this project will make possible the elaboration of a strategic framework for a large program of investments in the lake basin during the project implementation. The program will aim to provide Governments with the necessary skills, information, technical and financial resources, and a proper institutional and legal framework to carry out successfully such an endeavor.

5. Scope of the Analysis

5.1 The scope of the analysis should include all other significant changes brought on by the decision to undertake the alternative instead of the baseline. In the current context, each component of the project would provide some element of national benefits, and some global and it would be unrealistic to work these out to any level of precision: except for a need for cooperation in the specific projects etc.

5.2 In order to address the tradeoffs between these objectives which cut across national boundaries, a further project objective is to harmonize national management programs in order to achieve, to the maximum extent possible, the reversal of increasing environmental degradation.

6. Incremental Costs

6.1 The full complement of activities pursued at the national level by each of the riparian countries within the Lake Victoria basin constitutes the baseline, and the enhancement of these efforts to address transboundary problems to meet the regional and global objectives constitutes the alternative strategy. The alternative strategy will be facilitated by providing the governments with the necessary skills, information, technical and financial resources, and a proper institutional and legal framework to carry out successfully such an endeavor.

6.2 With regard to the global benefits, complementing the baseline with the proposed alternative strategy will ensure the better management and sustainable utilization of the Lake' s resources, secure the ecosystem health and biodiversity of the Lake. This would allow in the longer term a monitoring of the changes of biology and speciation associated with the *cichlids* fish.

6.3 For the baseline domestic benefits, we have to consider the situation at two levels: on a country by country basis, and at an aggregate level. If there were no GEF project each country would continue to act in their own interests, but because of the "commons" issues, the biotic and abiotic resources would be undermined, and in turn the long term use of the resources would not be sustainable. Coordinated plans between the three countries would enable a sustainable use environment and ecosystem health of the lake.

6.4 The project period here is 5 years. Constructing the baseline for the project would necessitate the formulation of the baseline profile for each of the three riparian countries, undertaken separately. The activities to be undertaken for the alternative cut across between the countries. Table 1 shows the costs for the baseline and the proposed alternative, presented here desegregated for the individual countries, and then presented in an aggregated manner.

6.5 What the matrix provides is the costs of undertaking the activities associated with each component under the baseline, and then the additional costs that would be required for the alternative strategy as add-ons. This is presented here for each country, and then aggregated for the Lake catchment as a whole. In reality, there would be cost savings to the baseline when undertaking some of the additional activities of the alternative strategy. These costs avoided should be deducted from the costs estimated under the alternative. It is unclear whether this has been done, or not. But in general projects should handle this well.

6.6 Specifically, the main components of the LVEMP to address transboundary environmental concerns are:

- establish mechanisms for co-operative management by the three countries
- identify and demonstrate practical, self-sustaining remedies
- building capacity for ecosystem management.

Each of the components of the LVEMP will be facilitated through two sets of activities:

- those which address specific environmental threats: at pilot zones
- information provision and capacity building: lake-wide in scope (pp. 13).

6.7 The main actions include: (a) regional cooperation in fisheries research, extension and management; (b) research and monitoring of water quality and pollution, strengthening and harmonization of pollution regulatory, incentive and enforcement systems, and priority investments in waste water management; (c) management of land use in the catchment (including soil conservation and afforestation) and sustainable use of wetlands; (d) control of water hyacinth; and (e) provision and enhancement of an institutional framework

6.8 There are, however, significant transaction costs which act as barriers to achieving these benefits, as demonstrated by the lack of progress to date. Examples of the barriers are the lack of institutional capacity, information and scientific understanding.

7. Results

7.1 Table 1 provides a summary of the various cost components listed and arranged in a format recommended in the GEF Council paper.

7.2 In addition to financing the baseline and adjusted baseline measures from non-GEF (IDA) sources, the three riparian governments have agreed to contribute US$ 3.8 million from their own resources to finance a part of the project's incremental cost. They have requested a GEF grant of US$ 35 million to fund the balance.

8. Issues, Actions, and Risks

8.1 It is the need for **(scientific) information** that makes the project a **costly** one. Research is seen as fundamental to the process for designing the appropriate action. What is most important is that the research be undertaken with very clearly defined and designed questions, so that it answers questions of science, management and policy. The project duration is five years and although this may allow for some information gaps to be filled, there are some questions which need longer periods of research and/or monitoring. At the moment it is difficult to get a clear sense of these issues, but these are clearly important considerations, for any long term success of the project.

8.2 In terms of incremental costs, the rationale for the involvement of the GEF can be argued on the basis of these operational programs. The incremental costs in the Table are presented as a breakdown of the costs for each of the three countries (Uganda, Kenya and Tanzania) as well as collectively. What is less obvious is the baseline situations which we are working upwards from. The environmental problems in Lake Victoria are well articulated throughout the report, but it is difficult to get a sense of the baseline situation in each country with regard to each of these problems. The information in the project document is not provided in a clear, explicit form and the information here has been 'retrofitted' for demonstration purposes only.

TABLE 1: INCREMENTAL COST MATRIX FOR THE LAKE VICTORIA PROJECT (US$ mil)

	KENYA		TANZANIA		UGANDA		AGGREGATE		AGGREGATE
	BL	ALT	BL	ALT	BL	ALT	BASELINE (BL)	ALTERNATIVE (ALT)	INCREMENT
Global benefits							• uncoordinated plans	• better co-ordinated plans	• improved biodiversity and water resources management
Domestic benefits							•	•	•
Activities (costs) (a) Fisheries • research • extension • legal f' work • fish levy trust	1.61	1.61 3.11	6.09	6.09 2.61	7.97	7.97 5.13	15.67	15.67 8.85	8.85
(b) Water quality mgmt. • water quality monitoring • industrial & municipal waste mgmt	4.51	4.51 2.88	3.06	3.06 3.01	3.28	3.28 2.73	10.85	10.85 8.62	8.62
(c) Land use and wetland mgmt • land use issues • wetlands	2.61	2.61 2.80	1.96	1.96 2.14	2.11	2.11 2.47	6.68	6.68 7.41	7.41
(d) Water hyacinth control	1.28	1.28 1.51	1.08	1.08 1.26	1.46	1.46 1.71	3.82	3.82 4.48	4.48
(e) Institutional framework	0.14	0.14 1.22	0.14	0.14 1.28	0.11	0.11 1.10	0.39	0.39 3.60	3.60
TOTAL	10.15	21.67	12.33	22.63	13.93	25.07	36.41	69.17	32.96

Note: The alternative activities are 'additional' activities, and their costs are estimated as 'add-ons'. In reality, however, there should be cost-savings/costs avoided which would need to be taken into consideration (see text).