An Ecosystem Approach to Restoring West African Drylands and Improving Rural Livelihoods through Agroforestry-based Land Management Interventions

Project Description

United Nations Environment Programme

In partnership with

World Agroforestry Centre

University of Florida

Governments of Burkina Faso, Mali, Mauritania, Niger, and Senegal

UNITED NATIONS ENVIRONMENT PROGRAMME
<u>PROJECT SUMMARY</u>

1.1   Title of Sub-Programme: Policy Development and Law

1.2   Title of Project: An Ecosystem Approach to Restoring West African Drylands and Improving Rural Livelihoods through Agroforestry-based Land Management Interventions

1.3   Legislative Mandate: Agenda 21 (Chapters 3, 12, 14), WSSD (<u>WEHAB</u>), UNEP GC.21/1, 21/24, 22/1, 22/2, 22/9, 22/10.

1.4   Project No: CP/2000-04-03

1.5   Geographical Scope: Regional, West African Drylands (Burkina Faso, Mali, Mauritania, Niger, Senegal)

1.6   Implementation: UNEP, World Agroforestry Centre (ICRAF), & University of Florida (UF)

1.7   Duration of the Project: 36 months, 1 November 2004 to 31 October 2007

1.8 Cost of Project:	**Total**	**%**
Cost to the CP of Norway *(Equivalent to 13 million Norwegian Kroner as in the signed agreement)*	**1,900,000**	**86**
UNEP in kind contribution	**100,000**	**5**
ICRAF in kind contribution	**200,000**	**9**
Total cost of the Project:	**2,200,000**	**100**

Project Summary:

This new project will contribute to the implementation of DPDL-UNEP's 2004-2005 Biennial Programme (UNEP GC.22/6) Programme Element 2.4: Policy Review, Analysis and Development, in particular Programme Component 2.4.2: to provide technical assistance and capacity building to countries to implement appropriate policies, strategies and action plans for advancing sustainable development objectives. The project aims to promote an ecosystems approach for sustainable management of the Parkland ecosystems (integrated crop-tree-livestock systems) of the semi-arid lowlands of West Africa. The project will build regional and local capacity in environmental policy development for restoring the West

African Parklands with the ultimate aim of improving human well-being and alleviating poverty. More specifically, the project will (a) build capacity of village communities in sustainable land use planning and conservation agroforestry practices; (b) train national teams in five countries in quantitative characterization of land degradation, and targeting, evaluation and monitoring of policy and conservation agroforestry interventions; (c) locate land degradation hot spots in the region and spatially target recommendations on appropriate policy and agroforestry-based land conservation practices; (d) produce guidelines and case studies for characterization of dryland degradation, targeting interventions and monitoring impact; and (e) provide guidelines and case studies for improved national and regional policy based on adaptive ecosystem management. Activities will be principally undertaken through partnership with the World Agroforestry Centre (ICRAF), the University of Florida Center for Environmental Policy (UF/CEP), national institutions in the five participating countries (Mali, Burkina Faso, Mauritania, Niger, Senegal), and regional policy networks such as UNCCD-RAPs, AMCEN, NEPAD, CILSS, and INSAH. The project will complement UNEP's support for the implementation of the UNCCD, by aiming to restore degraded drylands in Africa, prevent further desertification and promote sustainable land management as an integral part of national development policies, strategies and plans.

Acronyms used:

AMCEN	African Ministerial Conference on the Environment
CBD	Convention on Biological Diversity
CILSS	Comité Permanent Inter-Etats de Lutte Contre la Sécheresse au Sahel
DPDL	Division of Policy Development and Law, UNEP
DMP	Desert Margins Programme
ICRAF	World Agroforestry Centre
IER	Institut d'Economie Rural, Government of Mali
INERA	Institut de l'Environnement et de Recherches Agricoles, Government of Burkina Faso
INRAN	Institut National de Recherches Agronomiques du Niger, Government of Niger
INSAH	Institut du Sahel
ISRA	Institut Sénégalais de Recherche Agricole, Government of Senegal
LADA	Land Degradation Assessment for Drylands
MDRE	Ministere du Developpement Rural et de L'Environnement, Government of Mauritania
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
RAP	Regional Action Programme
UNCCD	United Nations Convention to Combat Desertification in those countries experiencing serious drought and/or desertification, particularly in Africa
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UF	University of Florida
UF/CEP	University of Florida Centre for Environmental Policy
WEHAB	Water, Energy, Health, Agriculture, Biodiversity initiative of WSSD
WSSD	World Summit on Sustainable Development

UNITED NATIONS ENVIRONMENT PROGRAMME
PROJECT DOCUMENT
<u>**SECTION 1 - PROJECT IDENTIFICATION**</u>

1.1   Title of Sub-Programme: **Policy Development and Law**

1.2   Title of Project: **An Ecosystem Approach to Restoring West African Drylands and Improving Rural Livelihood through Agroforestry-based Land Management Interventions**

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SECTION 2: BACKGROUND AND PROJECT CONTRIBUTION TO OVERALL SUBPROGRAMME IMPLEMENTATION

2.1 Background:

UNEP's focus on drylands has been largely driven by the fundamental principles laid out at the United Nations Conference on Environment and Development (UNCED), notably in Chapter 12 of Agenda 21 Programme of Action for Sustainable Development (1992) on managing fragile ecosystems: combating drought and desertification. Also particularly relevant are Chapter 10 on integrated approach to the planning and management of land resources, and Chapter 14 on promoting sustainable agriculture and rural development. These principles were reinforced in the Plan of Implementation of the World Summit on Sustainable Development (2002) in which high priority was given to poverty eradication and protecting and managing the natural resource base of economic and social development. Tools for achieving these goals under the plan include combating desertification and reversing current trends of degradation of land and water resources, for instance through promotion of sustainable agriculture and protection of ecosystems. The plan calls for provision of adequate and predictable financial resources for implementation of the UNCCD and increased synergy with the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity. These priorities for dryland management were reinforced by the UNEP 21st Governing Council (2001; Decision GC. 21/1) and in UNEP's Strategy on Land Use Management and Soil Conservation (UNEP Policy Series 4; 2004), which advocates an ecosystems approach to sustainable land management.

UNEP is developing an initiative on dryland environmental policy that promotes an ecosystems approach to sustainable dryland management. Projects under the initiative employ a multi-scale ecosystems methodology, starting with a continental overview and sampling frame, and then moving down to implement pilot projects in selected countries in vulnerable regions. A common methodology is used in all the projects so that results from different regions can be aggregated to form a basis for setting international policy priorities. Within Africa, regional projects are proposed for eastern Africa, West Africa, and southern Africa. This project comprises the West Africa component of the initiative.

Rationale and Justification

Managing the world's dryland environments is perhaps one of the most challenging and pressing development problems of today. Drylands are fragile ecosystems and its people are extremely vulnerable to environmental and global change. The problems are severe and of large extent—the drylands support one billion rural poor across 110 countries. The natural resource base on which the rural poor depend for their livelihoods is rapidly degrading, with as much as 70% of all land already degraded to some extent. Many dryland populations will face acute water shortages over the next few decades. Without urgent policy action there is a high risk of further rapid environmental degradation and spiralling poverty.

Unfortunately, development interventions in the drylands have not had a high success rate. This has been partly due to lack of understanding of how to manage these complex and fragile ecosystems, but also due to short-term thinking and under-investment in dryland development. However, new knowledge, paradigms and principles for sustainable dryland management are emerging based on the hard lessons from these past experiences. At the same time, UNEP, which has a long history of involvement in the drylands, has recently re-organized itself to better implement integrated approaches to tackling environmental problems. Accordingly, UNEP promotes dryland environmental management that incorporates new knowledge on ecosystem management. This project provides an opportunity to implement, test and further develop UNEP's ecosystems approach to dryland environmental management.

2.2 Legislative Authority and Contribution to Sub Programme:

UNEP's Subprogramme on Policy Development and Law is based on the intergovernmental commitment to the outcomes of Governing Council sessions and the World Summit on Sustainable Development and the WEHAB initiative arising out of the World Summit. This project will contribute to the implementation of UNEP's 2004-2005 Biennial Programme (UNEP GC.22/6) Element 2.4: Policy Review, Analysis and Development, in particular Programme Component 2.4.2: to provide technical assistance and capacity building to countries to implement appropriate policies, strategies and action plans for advancing sustainable development objectives. This project will directly contribute to several outputs of the Subprogramme strategy, namely to:

- Assist governments in policy development for environmentally sustainable land use and soil conservation
- Provide technical assistance on ecosystems (water, land, forests, etc) in order to achieve a clear understanding of conditions, trends, and impacts on social and economic conditions at the local and national levels.
- Provide technical assistance in environmental policy and management responses with the aim of identifying priority areas at the national and local levels needed to improve the social/economic conditions of the local populations and particularly the poor, in line with the World Summit priorities.

These outputs are in accordance with UNEP's mandate as specified by the UNEP Governing Council Decision GC.21/1 Land Degradation), GC.22/9 (Support for Africa), and GC.22/10 (Poverty and Environment in Africa).

By improving human capacity to tackle dryland degradation in the West Africa region, the project will directly contribute to the global objectives of the UNCCD, and other global environmental conventions that recognize the importance of addressing land degradation, including the Convention on Biological Diversity (CBD), and the United Nations Convention on Climate Change (UNFCCC).

SECTION 3: NEEDS, RESULTS

3.1 Needs:

About 40% of Sub-Saharan Africa is covered by drylands, in which 206 million people or 36% of the total population lives. Poverty levels are extremely high—the average Human Development Index in Sub-Saharan African countries that have large dryland areas is as low as 0.35.

Sustainable agricultural development will play a crucial role in addressing food and income security and eradicating poverty in Africa. In order to achieve the Millennium Development Goals, agricultural productivity in many sub-Saharan countries will need to dramatically increase, at a rate of about 6% per year in many countries, without harming the environment. Agriculture-poverty–environment linkages are particularly important in the semi-arid lowlands of West Africa (the Sahel), due to the sensitive environments and extreme poverty levels. The Sahel is a 700,000-km^2 belt extending across Mauritania, Senegal, Mali, Burkina Faso, and Niger, containing over half of the total population of these countries. The area is characterized by a 9-month dry season and frequent droughts. Abject poverty is prevalent and population growth rates at 3% per annum exceed food production growth rates of only 2% per annum. The traditional Parkland system (integrated crop-tree-livestock systems), which is the predominant land use system and the main provider of food, nutrition, income, and environmental services, is rapidly degrading—woody biodiversity and cover is being lost, and soil fertility is declining from already low levels through exhaustive cropping practices and soil erosion. There is an urgent need to restore and protect the Sahelian Parklands for the future welfare of over 40 million people living in the semi-arid drylands of West Africa.

Past, sectoral, approaches that have led to the current state of dryland degradation have lacked sufficient understanding of the complexity and sensitivity of dryland ecosystems, and there is currently a lack of effective policies and actions to achieve social and ecological sustainability at regional scales. There is need for a new, ecosystem approach to dryland environmental management, based on adaptive management that brings about:

1. Sustainable land use planning and management practices by village and pastoral communities.
2. Development of national and regional policies that promote adaptive land management interventions and improve rural livelihoods while maintaining ecosystem-regulating services.

Ecosystem approaches recognize the need to maintain provisioning services of ecosystems (such as food, fibre, fuel, freshwater) through maintenance of ecosystem supporting and regulating services (such as hydrological regulation, nutrient cycling, and biodiversity). Adaptive management of ecosystems aims to promote, within national development processes, more reliable and efficient learning from project experience through use of scientifically rigorous testing of policy and management interventions. This includes careful attention to initial regional characterization of land degradation problems, appropriate targeting of interventions, scientific evaluation of policy options, and careful design of

impact monitoring protocols, using baselines, replication and controls. A regional approach is needed to help ensure that solutions match the scale of the dryland environmental problems and that scarce resources are wisely targeted to where they are most needed. At a local level, there is need to build capacity of communities for adaptive management strategies based on income-generating agroforestry practices integrated with other soil conservation practices and local land use planning.

More specifically, the lack of reliable information on what land degradation problems are occurring where, and the inability to value environmental goods and services pose fundamental constraints to environmental policy development and integration in developing countries. These constraints are abundantly clear from the general descriptions and simplified prescriptions typically found in published regional, sub-regional and national action plans.

The project will address these needs by introducing and implementing an ecosystems approach to sustainable management of the Parklands. The approach has three main components—land degradation surveillance, policy evaluation and conservation agroforestry interventions. The first component, land degradation surveillance, will provide basic environmental information (such as vegetation cover dynamics, soil quality) and identify degradation hot spots (areas with extreme land degradation) in the region to help target agroforestry extension efforts to where they are most needed, measure impacts on the land resource base, and help extrapolate findings to other areas of the region. African developing countries have extremely limited information on their land and soil resource base. Current soil information systems are based on data from very limited numbers of soil profiles, interpolated using soil classification systems that are based on intransient subsoil properties. These data are perhaps adequate for coarse mapping of land resource potential, but do not provide information on the current status or time trends in soil quality of the topsoil, which is critical for soil fertility and hydrological functioning, and soil degradation assessment. The land degradation surveillance methodology, developed by ICRAF, adapts principles from public health surveillance systems and aims to: (1) provide diagnostic information that can be applied in guiding resource allocation and management decisions, (2) identify cause-and-effect relationships needed for primary prevention, early detection and outcome management, and (3) disseminate this information to stakeholders for action. This component will complement on-going initiatives (e.g. LADA, DMP) by introducing this new methodology, including new technology for rapid assessment of soil quality using visible-near-infrared reflectance spectroscopy and new statistical approaches for linking ground observations on land degradation to satellite imagery, which together advance rigorous assessment of land degradation.

The second component, will use data from the land degradation surveillance in conjunction with environmental accounting techniques, to evaluate the economic and environmental cost of land degradation at national to local levels in terms of environmental and economic sustainability, and help select policy alternatives at these different scales that will maximize public benefit and sustainability, taking into account environmental, social and economic concerns. Environmental accounting provides a sound basis for integrated policy evaluation but is not yet widely used for policy development in developing countries. Policy makers and scientists will be introduced to an environmental accounting method (*emergy* analysis) that

permits environmental resources and services to be valued and explicitly incorporated, together with social and economic concerns, in development decision-making. *Emergy* is a quantitative measure of the resources required to develop a product (whether a soil resource from biogeologic processes, a biological resource such as wood, or and economic product that results from industrial processes) and expresses the required resources in common units of one type of energy. *Emergy* synthesis provides a framework of comparative indices that can be evaluated across scales wherein the external and often indirect work of the environment can be internalised to policy decision making.

Guided by the environmental accounting evaluations, the third component will promote the adoption of conservation agroforestry and sustainable land management practices in village communities and supporting policies from village to national scale. New silvicultural techniques will be introduced to accelerate tree development and generate greater income through introduction of high value trees generating high-nutrition foods, medicinal and other high-value products. The project emphasizes regional and national capacity building through training courses and hands-on training for policy makers, scientists, natural resource managers, extension staff, and village communities.

The project is designed to be complementary to on-going projects in the region, such as DMP and LADA, by contributing new methodologies for land degradation surveillance, policy evaluation and conservation agroforestry, and building national capacity in these areas. More specifically, the project will help to strengthen soil surveillance and environmental accounting in DMP, which has is main focus on biodiversity in agroecosystems, and contribute capacity building in agroforestry towards DMP's conservation and livelihoods strategies. The land degradation surveillance and environmental accounting methodologies will contribute to LADA's objectives to develop tools for land degradation assessment and build national and regional assessment capacities for planning and implementing sustainable land management interventions. Synergies through joint work at pilot sites will also be explored with these projects.

3.2 Results:

The project places strong emphasis on local and national capacity building with the following expected results:

- Improved rural livelihoods through increased adaptive capacity among pilot village communities in local land use planning and agroforestry-based land conservation practices.
- Improved capacity among national and regional policy institutions for targeting and testing of adaptive policy and agroforestry-based management interventions for sustainable management of dryland ecosystems and improved livelihoods in West Africa.
- Core of national research and development workers in West African pilot countries with capacity for implementing ecosystem approaches to dryland management, including land degradation surveillance, policy analysis using environmental

accounting, and scientific design and testing of policy and agroforestry-based land management interventions.

- National research and development workers support and utilize rigorous methods for targeting land management interventions in semi-arid areas, and monitoring their impacts on productivity, biodiversity, soil quality, and human well-being.
- National and regional policy makers test and adopt approaches to support adaptive ecosystem management and systematic evaluation of alternative policies, strategies and plans for sustainable land management that benefit the environment, the economy and the public welfare.
- Local authorities and farmers adopt best-bet agroforestry and policy alternatives at pilot sites in the region.

3.3 Assumptions to achieve results:

It is assumed that key stakeholders (governments, agencies, regional organizations, village communities, NGOs) will fully participate in the capacity building activities covered by the project. The project assumes that improved targeting of agroforestry and supporting policy interventions to areas undergoing severe Parkland degradation will result in improved adaptive capacity of local communities, reduced poverty and enhanced ecosystem services through increased income from tree, crop and livestock products and more resilient agroecosystems.

3.4 Impact on poverty alleviation:

Over 40 million people living in the semi-arid drylands of West Africa depend on the traditional Parkland system (integrated crop-tree-livestock systems) as the main provider of food, nutrition, income, and environmental services. Degradation of the Parkland system is threatening the livelihoods of the already impoverished rural population.

The project aims to improve rural livelihoods through increased income from tree, crop and livestock products and more resilient agroecosystems by increasing the capacity of pilot village communities in local land use planning and agroforestry-based land conservation practices and improving capacity among national and regional policy institutions for targeting and testing of adaptive policy and agroforestry-based management interventions.

Further, the project will complement UNEP's Poverty and Environment project (Strengthen Environmental Policy and Management Capacity at the National and Local Levels as a Contribution to Poverty Alleviation and Sustainable Development in Africa) by building national capacity in new methods for quantifying land degradation and evaluating the importance of land degradation in relation to the economic and environmental resource base. These methods provide a systematic basis for evaluation and targeting of land use interventions and policy alternatives that simultaneously consider human, environmental and economic welfare. The choice of countries for implementation of this project was also made to provide to maximize the synergy with the UNEP Poverty and Environment project.

SECTION 4: WORKPLAN AND TIMETABLE, BUDGET, FOLLOW-UP

4.1 Outputs and activities:

The implementation approach of the project is to build national capacity in ecosystems approaches to dryland management through joint implementation by scientists from advanced scientific institutions with national research and extension staff, natural resource managers and farmers. Thus all the activities and outputs contribute to the capacity building objectives of the project.

The project will be implemented at two levels: community-based pilot projects will be nested within a regional targeting and policy framework to maximize impact and replicability. At the regional level, new rapid but reliable remote sensing methods for diagnosis of land/soil degradation, developed by ICRAF, will be used to characterize Parkland and soil degradation in the region, identify priority sites for pilot intervention projects, and establish baseline and monitoring protocols for pilot project areas in the five countries. This approach will provide efficient spatial targeting of land management recommendations and policies; permit soil quality and Parkland restoration to be subsequently monitored; and provide a sound basis for extending policy and agroforestry recommendations to other locations within the region.

Using the platform of regional networks (UNCCD Agroforestry Thematic Networks in Africa, CILSS, NEPAD), UNEP's Division of Policy Development and Law (DPDL) will build regional awareness among policy-makers on ecosystem approaches to dryland environmental management and provide national and regional guidelines and policy options for sustainable environmental management. Data generated by the land degradation surveillance component on land degradation prevalence, and risks associated with dryland use will significantly improve the economic/environmental evaluations of land degradation and help better identify and target improved policies. The Centre for Environmental Policy of the University of Florida (UF/CEP) will support UNEP by providing expertise in environmental accounting, including assisting in data collection and analysis, and training. The Centre for Environmental Policy has developed *emergy* accounting over the past 30 years and is the leading centre of excellence in this area.

At the pilot sites, UNEP, ICRAF and the University of Florida's Center for Environmental Policy will support national programmes, local development institutions and village communities to introduce community land use planning and agroforestry-based conservation farming practices aimed at enhancing ecosystem provisioning and regulating services of the Parkland systems and improving local livelihoods. Policy work at the pilot sites will focus on evaluation of ecosystem provisioning services (tree, crop, pasture production, water) and impacts of agroforestry alternatives, including land and tree tenure systems, on ecosystem regulating services (water and nutrient cycling, off-site effects). Best-bet agroforestry practices will be extended through demonstration trials to generate income through introduction of high value trees generating high-nutrition foods, medicinal and other high-value products. Introduction of high-value agroforestry systems in close proximity to villages will be used as a strategy to reduce pressure on outlying degraded areas. The multi-

11

scale policy analysis will help to guide policy at local to national scales to support rapid adoption of sustainable practices.

Pilot site activities will be initiated at the start of the project in Mali, where there is already a strong presence on the ground, while regional characterization activities are underway to identify suitable pilot sites in the other countries. The Mali site will then be used as a training site for the pilot sites teams in the other countries. Recommendations from the pilot projects will be fed back into the regional policy framework in the form of guidelines for targeting sustainable land management interventions and policies for improved ecosystems management and rural livelihoods that can be applied throughout the semi-arid lowlands.

The specific outputs and activities are listed below, grouped into those that occur at a regional scale and those that are confined to the pilot sites. The outputs are further grouped within these sections according to the project sub-components: land degradation surveillance, which focuses policy evaluation, which together help target and support agroforestry-based interventions.

Regional level

Land degradation surveillance
Output 1. Atlas with spatial database and statistical analysis of land degradation risk domains for the region and a sampling scheme for regional land degradation surveillance.
        Activity 1.1. Conduct statistical analysis of long-term Normalized Difference Vegetation Index data from the Advanced Very High Resolution Radiometer and ancillary data to delineate land degradation risk domains for the region.
        Activity 1.2. Sample these risk domains areas with moderate and high resolution satellite imagery at nested scales and classify images into vegetation cover classes.
        Activity 1.3. Identify candidate sites for ground sampling of degraded and control sites.
        Activity 1.4. Produce electronic and printed atlas.
Output 2. Training manual on land degradation surveillance.
        Activity 2.1. Develop and publish training manual on land degradation surveillance including satellite image acquisition and processing, field survey, soil spectral library development, and data analysis tools.
Output 3. Regional training course for national scientists on land degradation surveillance.
        Activity 3.1. Hold a 5-day regional training course for national scientists and resource managers on land degradation surveillance including satellite image acquisition and processing, field survey, soil spectral library development, and data analysis tools.

Policy evaluation

Output 4. Report on status of national environmental resources, sustainability trends and land degradation impacts for the five participating nations.

> Activity 4.1. Conduct national scale environmental accounting (*emergy* evaluation) on status of national environmental resources, and evaluate land degradation impacts on economic/environmental systems for Mali, Burkina Faso, Niger, Senegal, and Mauritania.
>
> Activity 4.2. Conduct a regional contrast with national scale *emergy* evaluation for seven other nations in the region less reliant on dryland resources (Benin, Nigeria, Ghana, Cote D'Ivoire, Guinea, Sierra Leone, and Cameroon).
>
> Activity 4.3. Conduct historic time series *emergy* analysis at 5-year intervals for Mali, Senegal and Niger.

Output 5. Guidelines (policy brief) on incorporating environmental sustainability concerns into national development plans and improving dryland resource management.

> Activity 5.1. Synthesize national environmental accounting results into a policy brief that addresses national dryland management in terms of internal funding allocation and policies for natural resource management.

Output 6. Regional training courses for national policy makers from the five countries in environmental accounting, policy evaluation and monitoring.

> Activity 6.1. Conduct a 3-day training course for national level policy makers and relevant stakeholders to present the conceptual framework for *emergy* synthesis as a natural resource policy guide, using results from the national scale evaluations and a custom-made software tool for environmental accounting.
>
> Activity 6.2. *Emergy* application workshops (3) for teams of scientists and policy makers: *emergy* synthesis techniques, data requirements, index interpretation and policy implications.

Output 7. Software tool on environmental accounting and policy evaluation at national scales for national policy makers.

> Activity 7.1. Produce a software tool for training and implementation by national policy makers on environmental accounting and policy evaluation at national scales for use by national policy makers throughout Africa (web- and CD-based, in English and French); includes templates for *emergy* synthesis at multiple scales.
>
> Activity 7.2. Prepare linked national scale databases for *emergy* analysis.

Agroforestry interventions

Output 8. Strategy document for wide dissemination of agroforestry options in Mali and the region.

> Activity 8.1. Design dissemination networks for regional dissemination of conservation agroforestry management and enrichment options in the Parkland systems.

Output 9. Extension manual on conservation agroforestry for Parkland restoration.

> Activity 9.1. Develop and publish extension manual on conservation agroforestry options for Parkland restoration.

Output 10. Regional training for national scientists in conservation agroforestry and demonstration of best bet conservation agroforestry options in pilot villages in Mali, and at a limited scale in Burkina Faso, Niger, Senegal, and Mauritania.

> Activity 10.1. Conduct a regional training course for national scientists from the five countries in conservation agroforestry and monitoring and assist national scientists to initiate agroforestry extension activities and monitoring in the other participating countries in the region.

Output 11. Seminars and advisory services on ecosystem approaches to dryland environmental management using land degradation surveillance, environmental accounting, and conservation agroforestry.

> Activity 11.1. Conduct two seminars for national and regional policy makers on ecosystem approaches to dryland environmental management using land degradation surveillance, environmental accounting, and conservation agroforestry; discuss project findings.
>
> Activity 11.2. Multiple seminars to relate project findings to relevant stakeholders and present tools that will enhance land degradation surveillance and environmental accounting in the region; designed for (i) non-scientific audience (policy makers, stakeholders), and (ii) technical audience (project scientists, natural resource managers).
>
> Activity 11.3. Provide follow-up advisory services to participating governments on environmental accounting and policy evaluation.

Output 12. Hyperlinked project web site and database archive.

> Activity 12.1. Maintain a hyperlinked project web site and database archive that will document, link and archive all project data.

Pilot sites

Land degradation surveillance

Output 13. Atlas with spatial database of land degradation baseline in Mali pilot extension village areas showing maps, processed satellite images, soil spectral libraries, and statistics on prevalence of land degradation problems, processes and intervention options.

> Activity 13.1. Conduct baseline ground survey and monitoring in selected pilot extension village areas in Mali.
>
> Activity 13.2. Equip and train Mali national soil laboratory in soil visible-near-infrared spectrometry technology.

Output 14. Hands-on training of Mali national scientists in land degradation surveillance.

> Activity 14.1. Provide hands-on training to Mali national scientists in land degradation surveillance protocol.

Policy evaluation

Output 15. Report and policy brief giving environmental evaluation and spatially targeted environmental policy guidelines for sustainable dryland management at district and village community levels in pilot extension areas.

Activity 15.1. In participation with district and village resource managers, conduct environmental accounting at district and land use system levels in Segou Region in Mali as an exemplar of dryland regional vulnerabilities and land use pressures; compile data on farm inputs and production; compile land degradation costs based on land degradation surveillance; evaluate locally important land management systems with and without interventions.

Activity 15.2. Conduct environmental accounting at district level for three additional pilot sites in the region in discussion with regional policy makers and stakeholders as end-members of environmental degradation and poverty.

Activity 15.3. Synthesize district accounts into a policy brief for natural resource management at the scale of districts; provide links between land degradation costs at the district scale and intervention requirements from national governments.

Output 16. Hands-on instruction for team of national scientists in environmental accounting and policy evaluation at village to national scales in Mali.

Activity 16.1. Provide hands-on instruction for team of national scientists and resource managers in environmental accounting and policy evaluation at village to national scales in Mali.

Agroforestry interventions

Output 17. Demonstration trials of best-bet conservation agroforestry options for pilot villages in Mali.

Activity 17.1. Develop, test and implement field trials of a wide range of participatory conservation agroforestry management (woodlots, fodder banks, live fences, improved fallows, tree nurseries) and enrichment options (based on improved silviculture of high value Parkland tree species) at farm and community levels with farmers and decision makers.

Output 18. Training courses for pilot village communities in Mali in land use planning and conservation agroforestry for sustainable land management.

Activity 18.1. Conduct two training courses, each for 15 pilot village communities and 15 development staff in Mali in land use planning and conservation agroforestry for sustainable land management.

Output 19. Monitoring report including protocol for participatory and technical monitoring, and georeferenced databases of baseline and monitoring of agroforestry adoption, tree performance and household welfare.

Activity 19.1. Conduct baseline survey and monitor agroforestry adoption, tree performance, soil quality and household welfare in selected Mali pilot extension sites.

Output 20. Hands-on training of national scientists in Mali in conservation agroforestry and monitoring.

Activity 20.1. Provide hands-on training of national scientists in Mali in conservation agroforestry and monitoring.

4.2 Work plan and Timetable:

UNEP will be responsible for the overall implementation of the project, will have primary responsibility for execution of the policy evaluation activities, and will coordinate production and translation of all project publications. ICRAF has primary responsibility for the execution of land degradation and agroforestry extension and monitoring activities, and on-the-ground coordination of the project in the region.

Activity	Nov-Dec 2004	Jan-Jun 2005	Jun-Dec 2005	Jan-Jun 2006	Jun-Dec 2006	Jan-Oct 2007	Lead institution
Regional activities:							
Activity 1.1. Conduct statistical analysis of long-term Normalized Difference Vegetation Index data from the Advanced Very High Resolution Radiometer and ancillary data to delineate land degradation risk domains for the region.	▓	▓					ICRAF
Activity 1.2. Sample these risk domains areas with moderate and high resolution satellite imagery at nested scales and classify images into vegetation cover classes.		▓	▓	▓	▓		ICRAF
Activity 1.3. Identify candidate sites for ground sampling of degraded and control sites.		▓	▓	▓			ICRAF
Activity 1.4. Produce electronic and printed atlas.					▓	▓	ICRAF
Activity 2.1. Develop and publish training manual on land degradation surveillance including satellite image acquisition and processing, field survey, soil spectral library development, and data analysis tools.		▓	▓	▓	▓		ICRAF
Activity 3.1. Hold regional training course for national scientists and resource managers on land degradation surveillance including satellite image acquisition and processing, field survey, soil spectral library development, and data analysis tools.				▓			ICRAF
Activity 4.1. Conduct national scale environmental accounting (*emergy* evaluation) on status of national environmental resources, and evaluate land degradation impacts on economic/environmental systems for Mali, Burkina Faso, Niger, Senegal, and Mauritania.	▓	▓	▓	▓			UNEP; UF/CEP
Activity 4.2. Conduct a regional contrast with national scale *emergy* evaluation for seven other nations in the region less reliant on dryland resources (Benin, Nigeria, Ghana, Cote D'Ivoire, Guinea, Sierra Leone, and Cameroon).		▓		▓			UNEP; UF/CEP
Activity 4.3. Conduct historic time series *emergy* analysis at 5-year intervals for Mali, Senegal and Niger.			▓	▓			UNEP; UF/CEP
Activity 5.1. Synthesize national environmental accounting results into a policy brief that addresses national dryland management in terms of internal funding allocation and policies for natural resource management.					▓		UNEP; UF//CEP
Activity 6.1. Conduct 3-day training course for national level policy makers and relevant stakeholders to present the conceptual framework for *emergy* synthesis as a natural resource policy		▓					UNEP; UF//CEP

Activity	Responsible party
guide, using results from the national scale evaluations and a custom-made software tool for environmental accounting.	
Activity 6.2. *Emergy* application workshops (3) for teams of scientists and policy makers: *emergy* synthesis techniques, data requirements, index interpretation and policy implications.	UNEP; UF//CEP
Activity 7.1. Produce a software tool for training and implementation by national policy makers on environmental accounting and policy evaluation at national scales for use by national policy makers throughout Africa (web- and CD-based, in English and French); includes templates for *emergy* synthesis at multiple scales.	UNEP; UF/CEP
Activity 7.2. Prepare linked national scale databases for *emergy* analysis.	UNEP/UF; CEP
Activity 8.1. Design dissemination networks for regional dissemination of conservation agroforestry management and enrichment options in the Parkland systems.	ICRAF
Activity 9.1. Develop and publish extension manual on conservation agroforestry options for Parkland restoration.	ICRAF
Activity 10.1. Conduct a regional training course for national scientists from the five countries in conservation agroforestry and monitoring and assist national scientists to initiate agroforestry extension activities and monitoring in the other participating countries in the region.	ICRAF
Activity 11.1. Conduct two seminars for national and regional policy makers on ecosystem approaches to dryland environmental management using land degradation surveillance, environmental accounting, and conservation agroforestry; discuss project findings.	ICRAF; UNEP; UF/CEP
Activity 11.2. Multiple seminars to relate project findings to relevant stakeholders and present tools that will enhance land degradation surveillance and environmental accounting in the region; designed for (i) non-scientific audience (policy makers, stakeholders), and (ii) technical audience (project scientists, natural resource managers).	UNEP; UF/CEP; ICRAF
Activity 11.3. Provide follow-up advisory services to participating governments on environmental accounting and policy evaluation.	UNEP; UF/CEP
Activity 12.1. Maintain a hyperlinked project web site and database archive that will document, link and archive all project data.	ICRAF; UNEP; UF/CEP
Pilot site activities:	
Activity 13.1. Conduct baseline ground survey and monitoring in selected pilot extension village areas in Mali.	ICRAF
Activity 13.2. Equip and train Mali national soil laboratory in soil visible-near-infrared spectrometry technology.	ICRAF
Activity 14.1. Provide hands-on training to Mali national scientists in land degradation surveillance protocol.	ICRAF
Activity 15.1. In participation with district and village resource managers, conduct	UNEP; UF/CEP

Activity							Responsibility
environmental accounting at district and land use system levels in Segou Region in Mali as an exemplar of dryland regional vulnerabilities and land use pressures; compile data on farm inputs and production; compile land degradation costs based on land degradation surveillance; evaluate locally important land management systems with and without interventions.							
Activity 15.2. Conduct environmental accounting at district level for three additional pilot sites in the region in discussion with regional policy makers and stakeholders as end-members of environmental degradation and poverty.							UNEP; UF/CEP
Activity 15.3. Synthesize district accounts into policy briefs for natural resource management at the scale of districts; provide links between land degradation costs at the district scale and intervention requirements from national governments.							UNEP; UF/CEP
Activity 16.1. Provide hands-on instruction for team of national scientists and resource managers in environmental accounting and policy evaluation at village to national scales in Mali.							UNEP; UF/CEP
Activity 17.1. Develop, test and implement field trials of a wide range of participatory conservation agroforestry management (woodlots, fodder banks, live fences, improved fallows, tree nurseries) and enrichment options (based on improved silviculture of high value Parkland tree species) at farm and community levels with farmers and decision makers.							ICRAF
Activity 18.1. Conduct two training courses, each for 15 pilot village communities and 15 development staff in Mali in land use planning and conservation agroforestry for sustainable land management.							ICRAF
Activity 19.1. Conduct baseline survey and monitor agroforestry adoption, tree performance, soil quality and household welfare in selected Mali pilot extension sites.							ICRAF
Activity 20.1. Provide hands-on training of national scientists in Mali in conservation agroforestry and monitoring.							ICRAF

SECTION 5: INSTITUTIONAL FRAMEWORK AND EVALUATION

5.1 Institutional Framework:

The main implementation approach of the project is to build capacity of national partners through joint implementation by staff from advanced scientific institutions working in teams with national staff on the ground to deliver the project outputs. Therefore, the main project activities involve hands-on training through joint implementation over the entire duration of the project, supplemented with formal training courses. In each country, activities will be undertaken through a partnership with the appropriate government agencies (INERA, Burkina Faso; IER, Mali; MDRE, Mauritania; INRAN, Niger; ISRA, Senegal). Each country

will nominate a national focal point, the person with whom the project will work with to ensure the timely and effective coordination of capacity building activities and other project activities. In some cases, the project may also work with university researchers or consultants to compile ecological and socioeconomic data. The project will also work with the UNEP Regional Office of Africa and the ICRAF Regional Coordinator to increase the effectiveness of communication with appropriate political and technical officials in countries.

UNEP is responsible for the overall implementation of the project and will have primary responsibility for execution of the policy evaluation activities with support from UF. ICRAF will oversee national and regional coordination and has primary responsibility for the execution of the agroforestry extension, monitoring and land degradation surveillance activities, in close consultation with UNEP. ICRAF will be responsible for administering the Letters of Agreements for the sub-contract components.

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5.2 Evaluation

Project evaluation will be conducted through annual reviews by the Programme Manager, partner representatives and country focal points. A final evaluation will be made by an external consultant and also by all stakeholders as part of the closing workshop.

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