

Medium-Term Plan 2009-2011



World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES



Transforming Lives and Landscapes
through Agroforestry Science

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2008

The World Agroforestry Centre is an autonomous, non-profit research organization. We receive our funding from over 50 different governments, private foundations, international organizations and regional development banks. Our current top 10 donors are Canada, the European Union, the International Fund for Agricultural Development (IFAD), Ireland, the Netherlands, Norway, Sweden, the United Kingdom, the United States of America and the World Bank.

Our Vision is a rural transformation in the developing world where smallholder households strategically increase their use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability.

Our Mission is to generate science-based knowledge about the diverse roles that trees play in agricultural landscapes and to use its research to advance policies and practices that benefit the poor and the environment.

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ABBREVIATIONS

ACIAR	Australian Centre for International Agricultural Research
ACTS	African Centre for Technology Studies
ADG	Assistant Director General
AEZ	Agro-ecological zone
AGRA	Alliance for a Green Revolution in Africa
AHI	African Highlands Initiative
ANAFE	African Network for Agriculture, Agroforestry and Natural Resources Education
APAARI	Asia Pacific Association of Agricultural Research Institutions
ARCS	Siebersdorf
ARI	Advanced Research Institute
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASB	Alternatives to Slash-and-Burn
ASIS	Africa Soil Information System
BoT	Board of Trustees
CAFNET	Coffee Network
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CBO	Community based organization
CCER	Centre Commissioned External Review
CERED	Centre for Environment Research, Education and Development
CFC	Common Fund for Commodities
CGIAR	Consultative Group on International Agricultural Research
CGRR	Corporación Grupo Randi Randi
CIAT	International Center for Tropical Agriculture
CIESIN	Center for International Earth Science Information Network
CIFOR	Center for International Forestry Research
CIP	International Potato Center
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
COMIFAC	Central African Forest Commission
COP	Conference of Parties
CORAF/WE CARD	West and Central African Council for Agricultural Research and Development
DDG	Deputy Director General
DFID	Department for International Development, UK
DG	Director General
EPMR	External Programme and Management Review
EU	European Union
FANRPAN	Food, Agriculture and Natural Resources Policy Analysis Network
FAO	Food and Agricultural Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FLD	Forest Landscape Denmark
FORNESSA	Forestry Research Network for sub-Saharan Africa
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
GP	Global project
GRP	Global Research Project
GSG	Global Steering Group
HR	Human Resources
ICARDA	International Center for Agricultural Research in the Dry Areas
ICIPE	International Centre of Insect Physiology and Ecology
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre
IER	Institut d'Economie Rurale du Mali

IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IIAM	National Agricultural Research, Mozambique
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IPCC	Inter-Governmental Panel on Climate Change
IPG	International public good
IRCSA	International Rainwater Catchments Systems
IRRI	International Rice Research Institute
ISEC	Institute for Social and Economic Change
ISRIC	International Soil Reference Information Centre
ITPGR	International Treaty for Plant Genetic Resources
IT	Information Technology
IUCN	World Conservation Union
IWMI	International Water Management Institute
KUL	Katholic University y Leuven
MTP	Medium -Term Plan
MoNRE	Ministry of Natural Resources and Environment
NARO	National agricultural research organisation
NARS	National agricultural research systems
NEPAD	The New Partnership for Africa's Development
NGO	Non-governmental organization
NRM	Natural resource management
PRESA	Pro-poor Rewards for Environmental Services in Africa
R&D	Research and Development
RAEZ	Regional Agro-ecological zone
REDD	Reduced Emissions from Deforestation in Developing countries
RUPES	Rewarding Upland Poor for Environmental Services
RWH	Research water harvesting
SADC	Southern African Development Community
SANREM CRSP	Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program
SCRI	Scottish Crop Research Institute
SEARNET	Southern and Eastern Africa Rainwater Network
SEARCA	Southeast Asian
SLT	Senior Leadership Team
SPs	CGIAR System Priorities
SWEP	Systemwide and Ecoregional Programmes
TSBF	Tropical Soil Biology and Fertility Institute
UCD	University College Dublin
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WWF	Worldwide Fund for Nature

Chapter 1

OVERVIEW

Introduction

The World Agroforestry Centre is in the final stages of publishing its new 2008–2015 Strategy that frames this 2009–2011 Medium–Term Plan (MTP). The new strategy articulates six coherent and interlinked Global Research Projects (GRPs) representing redirected and tighter choices from our past more *all encompassing* agenda. The evolution of our more focussed agenda from 11 projects in 2007, to 9 in 2008, to these final 6 projects has benefited from several inputs. These include: workshop retreats with our Board of Trustees; recommendations in our 3rd External Programme and Management Review (EPMR); stakeholder's views of ICRAF's roles in the Consultative Group on International Agricultural Research (CGIAR) collective action initiatives; two externally facilitated strategic planning exercises; donor consultations; and national and international partner surveys.

The rationale for the Centre's programme of research, development and education was evaluated against four criteria: salience (the global importance of the problem), credibility (capability to deliver), legitimacy (the Centre's comparative advantage relative to others) and fundability (potential to generate research funding). Each of our GRPs addresses both

livelihood and landscape issues to varying degrees and are guided by our revised mission statement which reads:

Our mission is to generate science-based knowledge about the diverse roles that trees play in agricultural landscapes, and to use its research to advance policies and practices that benefit the poor and the environment.

Highlights of the Project Portfolio

The 2009 project portfolio is a consolidation from our previous nested Theme structure that was operational from 2003 until early 2008. The interim structure operational in 2008 comprising nine Global Projects (GPs) was further distilled to six GRPs. The titles and summaries of the six projects are:

GRP1: Domestication, utilization and conservation of superior Agroforestry germplasm

This GRP aims to increase farmers' access to improved germplasm of priority tree species and ensure better functioning of tree seed and seedling supply systems.

GRP2: Maximizing on-farm productivity of trees and Agroforestry systems

Under this GRP, we will develop a better understanding and new approaches to nutrient cycling among trees, animals and crops. We will promote tree species diversity, develop coping mechanisms for climate-induced variability and consider tree–soil interactions when matching species to sites and systems.

GRP3: Improving tree product marketing for smallholders

Research under this GRP will focus on expanding smallholders' access to value chains for Agroforestry tree products and improving their incomes and livelihoods through better marketing.

GRP4: Reducing risks to land health and targeting Agroforestry interventions to enhance land productivity and food availability

This GRP will focus on developing multi-scale and widely usable methods of land health surveillance and will quantify and map major risks to land health at different scales. Efforts will be made to evaluate the cost effectiveness and outcomes of intervention programmes and to develop national capacity in operational methods and tools of land health surveillance.

GRP5: Improving the ability of farmers, ecosystems and governments to cope with climate change

The research aims to improve the stability of farming systems and livelihood strategies of smallholder farmers in light of current climate variability and long-term climate change. This will be achieved through farmers' increased use of trees for intensifying, diversifying and buffering farm systems. The focus will be on vulnerability assessments, the impact of climate change on Agroforestry systems, and adaptation to climate change in line with synergies in these systems between climate change adaptation and mitigation.

GRP6: Developing policies and incentives for multifunctional landscapes with trees that provide environmental services

Through this GRP, we will support better policies and the creation of incentives for maintaining the multifunctionality of landscapes with trees. This work will be based on improved understanding of the roles trees play in securing watershed services, storing carbon and maintaining biodiversity in landscape mosaics. It identifies opportunities for surpressing negative incentives and strengthening positive ones for Agroforestry solutions. Finally, studies will be undertaken on the important relationships between local and global drivers of land-use change.

New and Terminated Research:

The significant strategic changes and reasons for them are described for against six major areas where we shall discontinue activities and reorient our work as indicated:

- Our research on tree–crop interactions has produced strong understanding of the critical aspects, allowing us to discontinue our programme on tree–water relations and transpiration physiology. Future work is moving toward landscape-level interactions.
- Many aspects of component research on tree management have been completed, and work on this is being phased out. Future work in this area will focus on issues related to landscape-level management of Agroforestry systems.
- Our work on documenting tree biodiversity in Agroforestry is being phased out. Future work will emphasize the role of Agroforestry in conserving biodiversity at the landscape level.
- The role of trees in soil conservation has now been well documented, and future work will focus on integrating the technical and institutional aspects through Landcare approaches.
- The work on processing tree products is being phased out, and more emphasis will

be placed on researching value chains and marketing issues.

- Some aspects of our policy research at the local and national levels, related for example to biomass energy and charcoal, have now been replaced by work with a stronger emphasis on global environmental linkages, related for example to climate change adaptation and mitigation through Agroforestry.

Slower than Expected Progress in Previous MTP:

The 2008–2010 MTP was written during mid-2007 at a time when the centre was emerging from its 3rd EPMR and engaged in a new strategy development process. Notwithstanding the time consumed with these processes most of the 76 output targets promised in 2008 appear to be on track for attainment. The most significant gap is likely to be with the former GP1 where the project leader (Dr Frank Place) fell seriously ill and is still recuperating. Several GP9 output targets have been incorporated or subsumed into the reformulated GRPs.

Changes in Collaborative Arrangements:

The involvement of ICRAF with System-wide Programmes and Challenge Programmes remains largely unchanged from the situation described in the 2008–2010 MTP. The management of the myriad partnerships with national agricultural research institutes, advanced research institutes, sub-regional organizations, universities, CGIAR centres, private sector and non-governmental organizations (NGOs) has been centralized under a new Partnership Coordinator (Prof August Temu) in the Director General's Office.

The most significant development in collaborative arrangements has been the joint initiative with the International Livestock Research Institute (ILRI) on collective action for East and Southern Africa. Here ICRAF contributes actively with fellow CGIAR centres to the four flagship programmes, and engages directly with the two sub-regional organizations (Association

for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN)). This technical collaboration with ILRI, under the able leadership of Dr Ravi Prabhu, complements the operational alignment (Human Resources (HR), Information Technology (IT), Finance) already underway, and has attracted substantial attention as a model for future CGIAR integration.

ICRAF co-hosted the High-Value Crop Challenge Programme Meeting in Nairobi that led to the draft Challenge Programme proposal and is taking the lead in much of the fruit tree work.

The education and capacity building programme (ANAFE) that was started by ICRAF and partners in 1994 evolved into an independent organization in 2008, albeit still hosted on the ICRAF campus. This move opens up new collaborative opportunities with the 120 African academic institutions that comprise membership of this network.

Stronger programmatic ties were forged with the United Nations Framework Convention on Climate Change (UNFCCC) during the Bali Conference of Parties (COP). Here the Center for International Forestry Research (CIFOR), ICRAF and others co-hosted the very successful first International Forest Day that is set to become an annual event.

The 12-year-old System Wide Ecoregional Programme of the African Highlands Initiative (AHI) underwent an external review by the International Development Research Centre (IDRC). Although started by four CGIAR centres the AHI later became an integral ASARECA network. With ASARECA restructuring this has now been dissolved but activities and collaborations still persist. The IDRC review recommended a reorientation of AHI and during 2008/2009 it will be refreshed with needs assessment surveys, stakeholder meetings and eliciting of donor expectations. Currently,

demand is being expressed for a Natural Resource Management Platform for East and Southern Africa.

The World Agroforestry Centre was pleased to be able to co-host with ILRI the ninth meeting of the Science Council in 2008. Here the peculiarities and opportunities with trees on farms for more integrated work with the wider CGIAR were showcased. Insightful and substantive scientific engagement also occurred with Science Council members which helped develop further the content of our new strategic agenda.

CGIAR System Priority Alignment:

Our 6 GRPs contribute in distinctive ways to all 5 of the CGIAR System Priorities (SPs) and, more specifically, to 11 of the 20 sub-priorities: 1B, 2D, 3A, 3D, 4A, 4C, 4D, 5A, 5B, 5C and 5D. Most significantly they contribute in decreasing order to SPs 4A, 3A, 3D, 4D, 5A and 2D. In financial terms, some 84% of 2009 expenditure is projected to be within the SPs. In addition to bringing the unique 'trees in agriculture landscapes' perspective to the collective CGIAR research effort, the indicative CGIAR budgets for 2008 show that the World Agroforestry Centre is one of the top three centres for investments in sub-priorities 3A, 3D, 4D, 5B and 5C, as well as providing the primary financial investment in sub-priorities 2D and 4A.

Non SP Activities:

Following our new strategy we have focussed more attention on emerging research on climate change adaptation and policy, tree seed-and-seedling systems, tree-based agribusinesses, bundled environmental services and multifunctional agriculture. We feel these provide complementary science to that which we do as described under the system priorities. In 2009, approximately 16% of activities by financial value are categorized to be outside the SPs as they are currently described. This total is comprised of 7% for new research, 5% for development support and 4% for capacity building.

Financial Indicators

1. Financial outcomes in 2007

WorldAgroforestry's total nominal income (unadjusted for purchasing power and excluding the CGIAR Gender and Diversity Program) increased by about 4% from USD (\$) 30.4 million in 2006 to \$31.54 million in 2007. The increase was mainly due to exchange gains on unrestricted grant income due to a weak US dollar relative to other major donor currencies and an increase in unrestricted grant income. Of course, the view is less encouraging when judged in price-adjusted terms.

Total expenditure decreased by 8% from \$31.26 million in 2006 to \$28.82 million in 2007. This decrease is attributed to a reduction in restricted expenditure. In addition, WorldAgroforestry invested \$0.50 million in new and replacement capital assets.

Changes in net assets for year 2007 reflected a surplus of \$2.73 million (compared with a deficit of \$0.853 million in 2006). The delivery of the 2006 contribution of the European Union (EU) amounting to \$1.61 million helped WorldAgroforestry to achieve the surplus. The substantial surplus changed our year end financial position; as a result the total unrestricted net assets in the Centre increased to \$15.7 million from \$13 million in 2006. WorldAgroforestry's short-term solvency (liquidity) increased to 178 days. The long-term financial stability (adequacy of reserves) increased to 128 days. These indicators are above the upper thresholds recommended by the CGIAR Secretariat. The 2007 outcomes were approximately 8% lower than the estimates reported in the MTP submitted in June 2007 for income and expenditure.

a. Financial estimates for 2008

Total nominal income for 2008 is estimated at \$27.86 million, which is a decrease of about 5% compared to our MTP proposal submitted in June 2007. Expenditure in 2008 is estimated

at \$27.46 million, reflecting a decrease of about 5% compared to the figure presented in our MTP of June 2006. For 2008, no material change in net assets is anticipated and there are no proposals to draw from reserves to pay for operations.

b. Financial proposal and plans 2009–2011

The financing plan for 2009 included in the 2009–2011 MTP is based on known or highly probable sources of future grants. WorldAgroforestry is being highly conservative

in including probable sources in the 2009 financing plan, and we expect some moderate changes in the 2009 proposal. The plans for years 2010 and 2011 have been extrapolated on the basis of the 2009 financing plan, assuming a 4% average growth rate.

PROJECT NARRATIVES

Global Research Project 1: Domestication, utilization and conservation of superior Agroforestry germplasm

Project Overview and Rationale

Project Goal

Smallholder farmers, researchers and their support agencies have increased information, knowledge and capacity needed to improve rural livelihood options through use of well conserved, characterized and developed tree genetic resources via well functioning seed and seedling systems.

Project Objective

The overall objective of GRP1 is to increase access to improved germplasm of priority tree species and ensure better functioning of tree seed and seedling supply systems. In consequence, there are opportunities to improve and optimize productivity of Agroforestry systems through improved germplasm. GRP1 aims to provide solutions to the fundamental problems that constrain the productivity of Agroforestry trees.

Rationale

The objectives of GRP1 are to resolve fundamental problems that constrain effective productivity of tree genetic resources and tree

domestication. Such problems include but are not limited to the following:

1. Constraints to characterization, tree domestication and documentation and dissemination of information:
 - a. *Limited biological understanding of the range of useful tree species* posed by their perennial nature, life history traits (e.g. dioecy) with long generation intervals in working with tree propagation and growth; a need to modify and update priority setting exercises for Agroforestry species due to changing requirements influenced by markets niches climate change, biotechnology, etc. limited understanding and documentation of performance and productivity between exotic, indigenous and naturalized species; poor knowledge on nutritional and therapeutic values of indigenous species in agricultural landscapes; lack of understanding about invasiveness of introduced Agroforestry species; lack of adequate approaches and knowledge that allow multiple species to be domesticated.
 - b. *Absence of innovative tools and protocols for understanding genetic level diversity and conservation of tree germplasm:* lack of knowledge on appropriate *ex, circa* and *in situ* conservation strategies; longevity and

practicality of maintaining live gene banks of taxa with large growth forms; diversity among biological specificities of the range number of species involved, e.g. recalcitrance, reproductive biology, phenology, etc.; different niches; limited knowledge available on adaptability in response to climate change and land degradation; current methods mostly ineffective, fragmented and unnecessarily costly; inadequate understanding and awareness of problems and benefits of managing intra-specific diversity; limited understanding of the role and importance of diversity in Agroforestry systems; poor genetic quality in founder populations of tree seeds being released by development projects; potential risks of loss of tree vigour resulting from inbreeding and poor management of tree genetic diversity on farm and within landscape; dysgenic selection; limited knowledge of phenotypic plasticity of priority tree species; inadequate research on pests and diseases of Agroforestry trees; lack of comprehensive guidelines/indicators for managing intra-specific diversity; *ex ante* impact assessments of genetically modified trees in Agroforestry landscapes lacking, etc.

- c. *Scarcity of innovative tools and methodologies for tree propagation and management*: lack of generic protocols for participatory selection of priority Agroforestry species in different agro-ecological zones, taking emerging global issues into consideration (e.g. climate change adaptation); lack of global guidelines for domestication for researchers and stakeholders; lack of methodologies for elite clonal selection and development of cultivars of indigenous tree species (current methodologies are for exotic species); challenge of repeatability due to long generation time; limited knowledge of trade-offs between

biotechnological (tissue culture and genomics), participatory and non-participatory domestication approaches to tree improvement for Agroforestry species; lack of case studies to help extrapolate generic technologies; need for continuous monitoring and improvement of tree genetic resources and fine tuning of management practices in different niches; farmer uptake is below species saturation level due to lack of tested alternatives; efficient procedures for better-adapted indigenous species are often unknown resulting in focusing on few exotic taxa; current approaches are inflexible and often involve high market risks to producers thereby limiting adoption.

- d. *Obligation to routinely update information on domestication, distribution, use, management and conservation of Agroforestry tree species genetic resources*: There is a need to appropriately present updated information, in different formats and with the right amount of detail, to guide farmers, scientists, community based organizations (CBOs), NGOs and other stakeholders on the availability, management and use of the wide range of different Agroforestry tree species; unavailability of accessible Agroforestry databases to guide stakeholders in species selection for specific functions, e.g. mitigate and adapt to climate change, provide micronutrient security, provide health security through use of traditional health systems, lack of methods for recording current activities on the distribution, domestication and on-farm management of the wide range of Agroforestry tree genetic resources hence there is lack of learning from these activities; research is ongoing on many Agroforestry species, hence continuous updating of current information is required; in contrast to annual

crops, comprehensive information on tree germplasm is lacking; lack of development of databases participatory with stakeholders; lack of comprehensive guidelines on management tree genetic resources; tree species knowledge not freely available for all stakeholders.

2. Constraints to tree germplasm supply and availability: Tree seed and seedling supply systems are poorly developed mostly due to lack of developed markets, hence availability and supply is a problem. Tree seed supply is cited as a problem but tree seed demand is un-quantified. Scant economics data on tree seed and seedling production and current practices of germplasm transfers cross-landscapes are not well documented. The current International Treaty for Plant Genetic Resources (ITPGR) is not relevant to most tree genetic resources. The focus is on tree seed and not tree seedlings. There are no farmer-saved tree seed projects and there is lack of appropriate models for tree germplasm supply to farmers. There is need for proper analysis of the cost effectiveness, required incentives, and quality and quantity considerations at a farm and landscape level. Data on phenomena such as inbreeding and outbreeding in Agroforestry tree species at farm and landscapes levels is not widely available. Farmer access to germplasm of good physiological and genetic quality of a range of tree species is limited, resulting in limited adoption. There is planting of a few readily available species only on uniform farm landscapes that do not maximize productivity and sustainability, with market and environmental risks

The World Agroforestry Centre seeks to contribute towards the Millennium Development Goals for the eradication of poverty and hunger, the promotion of social equity, and the mitigation of global concerns related to climate change and environmental degradation by understanding and promoting Agroforestry in

the tropics. Agroforestry systems are ubiquitous within the tropics and they are constituted by an immense diversity among and within tree species found within contrasting biological and complex niches. Inherently they are of immense value for a varied group of farmers, partners and markets. There exist opportunities to improve and optimize productivity of Agroforestry systems. However, the immense diversity within the system poses major challenges in developing generic models and principles. The vast range of taxa, restricted current use, lack of market integration, and particular biological characteristics, mean that much variation remains untapped to improve livelihoods and environments within the context of current and emerging global challenges and opportunities.

GRP1 has two research outputs:

- GRP1.1: Improved tree germplasm and associated information developed through appropriate methods.
- GRP1.2: Sustainable tree seed and seedling supply systems developed while promoting conservation using appropriate partnerships.

Alignment with CGIAR System Priorities (Project Level)

GRP1 outputs align well with CGIAR system priorities: 1B (promoting conservation and characterization of under utilized plant genetic resources); 2D (genetic enhancement of selected species to increase income generation by the poor); 3A (increasing income from fruit and vegetables); 4A (integrated land, water and forest management at landscape level); 5D (improving research and development options to reduce rural poverty and vulnerability). The research at World Agroforestry Centre under output GRP1.2 (Seed and Seedling Systems), however, goes beyond the System Priorities and is largely listed as a new research area and development activity.

Outputs Description

Changes from previous MTP:

GRP1 is an enhanced and combined formulation of previous project GP2 (tree genetic resources and domestication). GRP1 has two outputs while previously there were three in GP2. First and foremost, previous output GP2.3 (existing strategies improved and new approaches developed for documenting and disseminating information on the use, domestication, distribution and management of Agroforestry tree species genetic resources) has been combined with the previous output GP2.1 (strategic technologies and management approaches developed and promoted for domestication, characterization and conservation of Agroforestry tree genetic resources) to form output GRP1.1 (improved tree germplasm and associated information developed through appropriate methods). Secondly, the component on conservation has been combined with the component on seed and seedling supply systems to form output GRP1.2 (sustainable tree seed and seedling supply systems developed while promoting conservation using appropriate partnerships) to ensure that both outputs of this project align with the CGIAR System Priorities.

Description (Output level)

GRP1.1: Improved tree germplasm and associated information developed through appropriate methods

GRP1.1 addresses the following two research questions:

1. Taking into consideration emerging challenges and opportunities arising from global warming, urbanization, increased international trade, biotechnology, hidden hunger and land degradation, what innovative approaches can be developed and used to domesticate, promote and conserve high-value tree species in partnership with smallholder farmers?
2. What are the most appropriate technologies for characterizing and selecting genetic

variation in Agroforestry trees, taking into consideration cost effectiveness, adoption potential and trade-offs?

GRP1 was formerly World Agroforestry Centre's projects Trees and Markets and Program 2 where the principal focus was on tree domestication for development of Agroforestry tree germplasm and practices to facilitate their wider adoption for improving rural livelihood. In addition to this, there has always been a major focus on characterizing, documenting and disseminating relevant information. GRP1 therefore has the historical expertise on content and gaps, well-trained capacity and well-established partnerships in developing countries where active research is being undertaken.

World Agroforestry Centre collaborates with international, regional and national partners to produce the outputs and promote achievement of the outcomes and impacts of GRP1.

The international partners primarily assist in molecular genetics work for marker assisted selection, development of strategies, databases, international policy formulation, multilateral conservation efforts, and advocacy. The international partners include: University College Dublin (UCD), ARCS Siebersdorf, Australian Tree Seed Centre, CAB International, CIFOR, Centre de coopération internationale en recherche agronomique pour le développement (CIRAD), Forest Landscape Denmark (FLD), European Forestry Institute, Food and Agricultural Organization of the United Nations (FAO), Ghent University, International Centre for Under-utilized Crops, International Institute of Tropical Agriculture (IITA), Bioversity, International Society Horticultural Science, Unilever, SNV, Mars, Scottish Crop Research Institute (SCRI) and Winrock International.

The developmental partners mainly collaborate and desire research findings linking directly into development projects. These partners include: Netherlands Development Organization. SNV,

Technoserve, World Conservation Union/ (IUCN/SECO), Mars Inc., Syngenta International AG and Unilever.

The regional partners primarily assist in regional networking and regional conservation efforts. The regional collaborators include: West and Central African Council for Agricultural Research and Development (CORAF/WE CARD), COMIFAC, Asia Pacific Association of Agricultural Research Institutions (APAARI), ASARECA, Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Forum for Agricultural Research in Africa (FARA), Forestry Research Network for sub-Saharan Africa (FORNESSA), and Southern African Development Community (SADC) Tree Seed Centre Network.

The national partners primarily engage with World Agroforestry Centre in developing and testing methods, developing improved germplasm and propagation methods, conservation of individual tree species, and assembling range-wide collections. The national partners include: national tree seed centres; national agricultural research institutes, national horticultural institutions, national forestry research institutes, universities, national health authorities (for fruit and medicinal species), national extension systems, and national quarantine authorities. In addition, nationally based NGOs and CBO partners will be engaged in scaling up research.

GRP1.2: Sustainable tree seed and seedling supply systems developed while promoting conservation using appropriate partnerships

GRP1.2 addresses the following three research questions:

1. What are the optimum *ex, circa* and *in situ* conservation strategies appropriate for managing and utilizing Agroforestry tree genetic resources in light of current and emerging global challenges and opportunities?

2. What are the most appropriate models for supplying tree germplasm to farmers, taking into account role allocation, cost effectiveness, incentives, and quality and quantity considerations at the farm and landscape levels?
3. What are the best systems and methodologies for procuring, storing, producing and distributing high-quality germplasm of priority tree species? What types of incentives are needed?

GRP1 was traditionally World Agroforestry Centre's projects Trees and Markets and Program 2 where the principal focus was on Agroforestry germplasm. GRP1 therefore has the historical expertise of content and gaps, well trained capacity and well established partnerships to contribute towards this goal of the project.

World Agroforestry Centre collaborates with international, regional and national partners to produce the outputs and promote achievement of the outcomes and impacts of GRP1.

The international partners primarily assist in molecular genetics work for marker assisted selection, development of strategies, databases, international policy formulation, multilateral conservation efforts, and advocacy. The international partners include: UCD, ARCS Siebersdorf, Australian Tree Seed Centre, CAB International, CIFOR, CIRAD, FLD, European Forestry Institute, FAO, Ghent University, International Centre for Under-utilized Crops, IITA, Bioversity, International Society Horticultural Science, Unilever, SNV, Mars Inc., SCRI and Winrock International.

The development partners mainly collaborate and desire research findings linking directly into development projects. These partners include: Netherlands Development Organization, SNV, Technoserve, IUCN/SECO, Mars Inc., Syngenta International AG and Unilever.

The regional partners primarily assist in regional networking and regional conservation efforts. The regional collaborators include: CORAF/WECARD, COMIFAC, APAARI, ASARECA, CATIE, FARA, FORNESSA, and SADC Tree Seed Centre Network.

The national partners primarily engage with World Agroforestry Centre in developing and testing methods, developing improved germplasm and propagation methods, conservation of individual tree species, and assembling range-wide collections. The national partners include: national tree seed centres; national agricultural research institutes, national horticultural institutions, national forestry research institutes, universities, national health authorities (for fruit and medicinal species), national extension systems, and national quarantine authorities. In addition, nationally based NGOs and CBO partners will be engaged on scaling up research.

Alignment to CGIAR System Priorities (Output Level)

GRP1.1 aligns to CGIAR System Priorities:

1B: Promoting conservation and characterization of underutilized plant genetic resources to increase the income of the poor

2D: Genetic enhancement of selected species to increase income generation by the poor

3A: Increasing income from fruits and vegetables

4A: Integrated land, water and forest management

5D: Improving Research and Development (R&D) options to reduce rural poverty and vulnerability

GRP 1.2 aligns to CGIAR System Priorities:

3A: Increasing income from fruits and vegetables

5D: Improving R&D options to reduce rural poverty and vulnerability

Countries of Planned Research (Output Level)

GRP1.1 and 1.2 carry out research in the following countries: Mali, Niger, Senegal, Burkina Faso, Ethiopia, Kenya, Tanzania, Malawi, Mozambique, Zambia, Zimbabwe, Uganda, Cameroon, DR Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana, Nigeria, India, Thailand, Sri Lanka, Bangladesh, Indonesia, Laos, the Philippines and China.

Impact pathways by Output

Outputs	Outcomes	Impacts
GRP1.1: Improved tree germplasm developed for prioritized tree species using participatory tree domestication and information for these and other key Agroforestry species updated and disseminated.	<ul style="list-style-type: none"> Sustainability and productivity of Agroforestry systems improved as farmers and other stakeholders domesticate and utilize a broader range of important tree species in more optimal ways thereby promoting current and future use. Greater availability of updated and well-documented information on key Agroforestry species will lead to increased species diversity in nurseries and on farm. 	<ul style="list-style-type: none"> Sustained and productive Agroforestry systems contributing towards alleviation of poverty and food security and protection of the environment.
GRP1.2: Sustainable systems of tree seed and seedling supply developed and tree genetic resources conserved using appropriate strategies.	<ul style="list-style-type: none"> Sustainable seed and seedling systems operating –availability of quality trees seeds and seedlings and innovative management practices. Enhanced tree diversity on farm. Better conserved tree germplasm. 	<ul style="list-style-type: none"> More buffered and productive farm environment contributing to poverty alleviation and better food security.

Target ecoregions

1. Sub-Saharan Africa

RAEZ1 Warm arid and semi-arid tropics (AEZ 1): West Africa: Mali, Niger, Senegal and Burkina Faso; East Africa: Ethiopia, Kenya and Tanzania; Southern Africa: Malawi, Mozambique, Zambia and Zimbabwe.

RAEZ 2 Warm sub-humid tropics (AEZ 2): East Africa: Uganda; Southern Africa: Malawi, Mozambique, Zambia and Zimbabwe.

RAEZ 3 Warm humid tropics (AEZ 3): Cameroon, DR Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Ghana and Nigeria.

2. Asia and the Pacific

RAEZ 8 Warm arid and semi-arid tropics (AEZ 1): India and Thailand.

RAEZ 9 Warm sub-humid tropics (AEZ 2): India, Sri Lanka and Thailand.

RAEZ10 Warm humid tropics (AEZ 3): Bangladesh, Indonesia, Laos, Philippines, Sri Lanka and Thailand.

RAEZ11 Warm arid and semi-arid subtropics with summer rainfall (AEZ 5): China and India.

Beneficiaries and end users

The primary beneficiaries of GRP1 are national tree seed agencies, farmers, tree nursery operators, national forestry and agroforestry research institutes, NGOs, universities and extension agents. The end users of the tree knowledge and tree germplasm produced by the project include: CBOs, development agencies, extension agents, farmers, inter-governmental bodies involved in germplasm transfers, international research institutions, local policy makers, national policy makers, national research institutions, NGOs, producer associations, regional bodies involved in germplasm regulation, and tree seed marketers.

International Public Goods

The two main types of international public goods (IPGs) produced by this project are tree knowledge and tree germplasm. Whilst substantial knowledge on trees in commercial

plantations and natural forest exist, scant information is readily available on trees for on-farm cultivation. Nearly 5000 tree species have been listed as occurring on farms in the tropics but information on their genetic make-up, management, propagation and conservation is lacking. The wide bioclimatic suitability of such a large number of both exotic and indigenous species ensures a high IPG value to the knowledge. The tree germplasm collected, conserved and produced by the Centre is used as founder populations for research and multiplication across national boundaries. Tree knowledge produced by this project includes general and species specific information. Both types of knowledge take the form of strategies, guidelines, domain recommendations, practices, methods and protocols. The germplasm IPGs are produced at village and national levels. Farmer-developed varieties (populations and clones) may be shared internationally, especially when part of a pre-agreed network and when *sui generis* IPR protection systems operate. Nationally developed germplasm at species, provenance and clonal levels are encouraged to be part of multilateral system

Elaboration of Partners' Roles

World Agroforestry Centre collaborates with international, regional and national partners to produce the outputs and promote achievement of the outcomes and impacts of GRP1.

The international partners primarily assist in molecular genetics work for marker assisted selection, development of strategies, databases, international policy formulation, multilateral conservation efforts, and advocacy. The international partners include: UCD, ARCS Siebersdorf, Australian Tree Seed Centre, CAB International, CIFOR, CIRAD, Forest Landscape Denmark (FLS), European Forestry Institute, FAO, Ghent University, International Centre for Under-utilized Crops, IITA, Bioversity, International Society Horticultural Science, Unilever, SNV, Mars Inc., SCRI and Winrock International.

The development partners mainly collaborate and desire research findings linking directly into development projects. These partners include: Netherlands Development Organization, SNV, Technoserve, IUCN/SECO, Mars Inc., Syngenta International AG and Unilever.

The regional partners primarily assist in regional networking and regional conservation efforts. The regional collaborators include: CORAF, COMIFAC, APAARI, ASARECA, CATIE, FARA, FORNESSA, and SADC Tree Seed Centre Network.

The national partners primarily engage with World Agroforestry Centre in developing and testing methods, developing improved germplasm and propagation methods, conservation of individual tree species, and assembling range-wide collections. The national partners include: national tree seed centres; national agricultural research institutes, national horticultural institutions, national forestry research institutes, universities, national health authorities (for fruit and medicinal species), national extension systems, and national quarantine authorities. In addition, nationally based NGOs and CBO partners will be engaged in scaling up research.

Global Research Project 2: Improved on-farm productivity of trees and Agroforestry systems

Project Overview and Rationale

Project Goal

Under this GRP2, we will develop a better understanding and new approaches for nutrient cycling between trees, animals and crops. We will also address the promotion of tree species diversity, coping mechanisms for climate-induced variability and tree–soil interactions in matching species to sites and systems.

Project Objectives:

1. To understand economic opportunities of diversified and intensified Agroforestry systems, including options for tree crops, and develop principles and guidelines for improved Agroforestry management and integrating Agroforestry in tropical smallholder farms.
2. To better understand the trade-offs between economic, environmental and cultural benefits for Agroforestry to benefit different types of smallholder farmers, including changes in tree species richness and evenness within tropical smallholder farming systems.
3. To assess the efficiency of water productivity and use of Agroforestry systems and to develop strategies for sustainable water management on small farms, and methods of Agroforestry systems that can explore and predict consequences of tree growth and economic benefits from diversified systems.

Rationale

In recent years, many smallholder farmers around the world have seen little improvement in their welfare because agricultural productivity has stagnated, prices for basic necessities are higher and input costs have increased faster than revenues, while production and market risks remain high. Most farmers in the tropics are not insured and operate in an environment of high uncertainty. They rely on local social networks—that may well share the same exposure to risk factors—for this function. Following the recommendations of agricultural advisors, many farmers have also become less insulated from risk because they now focus on monoculture production or on only one dominant farming enterprise. At the same time, fragmentation of tropical landscapes has resulted in reduced availability and increased costs of products and services that could previously be obtained from natural ecosystems adjacent to farming areas. Whereas Agroforestry systems can play an important role by providing new sources of ecosystem products and services, there is lack

of information on the best ways to diversify Agroforestry systems for optimal benefits for both the small-scale producers and the global community. This also includes the role of trees and Agroforestry in the vulnerability of rural communities and their resilience to recover from natural and man-made disasters (e.g. earthquakes, tsunamis and political conflicts).

Climate change and rainfall variability as well as land degradation and desertification are among the most important obstacles to the achievement of food (income) security and poverty reduction, thereby making life extremely difficult for smallholder farmers. It is also expected that a reduction of the planned, established and managed diversity of agricultural systems has impacted negatively on the stability of ecosystems, rendering them less able to cope with environmental shocks.

At the same time, it is expected that there is a marketing niche for medium-scale tree production systems that can offer greater livelihood options to farming communities than some well-established global monoculture cash crop production systems such as coffee, tea, rubber, cashew nut or cocoa.

Inadequate water supply is major constraint to agricultural production in drylands. In many cases, however, rains provide adequate quantities of water for optimal crop production but this water is lost, usually by overland flow, before the vegetation can use it. Water is also lost through poor tree management and landscape planning. For example, some fast growing tree species such as eucalyptus, pines and acacias are increasingly depleting the environment because their fast growth is matched by higher water and nutrient consumption.

Local and 'scientific' ecological knowledge on tree selection and management on farms is hardly available or non-existent for most native tree species. There is therefore a dire need to generate such information, which could be used

in strategies for integrating trees on small farms for increasing food and tree crop productivity. Information is also lacking on the trade-offs between economic and environmental benefits of indigenous tree species that are presently over-exploited in the wild and underutilized in agricultural systems.

GRP2 has two research outputs:

GRP2.1: Enhanced the better understood costs, benefits and risks of Agroforestry technologies and systems under varying conditions.

GRP2.2: Principles, methods and practices developed for improved tree and Agroforestry management.

Alignment to CGIAR Priorities (Project Level)

GRP2 matches most closely with CGIAR priorities 3A (increasing income from fruits and vegetables) and 3D (sustainable income generation from forests and trees) mainly on approaches and options development for improving opportunities for the market exploitation of a range of forest products by the poor. It also aligns with CGIAR priorities 4C (improving water productivity) mainly on improving the management practices to enhance the productivity of water for diversified smallholder farming systems and 4D (sustainable agro-ecological intensification in low- and high-potential environments). GRP2 also contributes to CGIAR priority 5D (improving research and development options to reduce rural poverty and vulnerability) by identifying agricultural research and development pathways, in order to implement options to reduce rural poverty.

Outputs Description

Changes from previous MTP

This GRP includes part of the research activities and outputs of a number of Global Projects in the previous MTP 2008–2010. These include all activities of GP3 (tree-based diversification and intensification of smallholder agriculture) and part of the research activities of other GPs, such

as the livelihood analyses of GP1 (multiscale assessment of Agroforestry impacts), the farm-level interface for some elements of GP5 (Agroforestry in multifunctional landscapes: trade-offs and synergies), e.g. biodiversity conservation and trees in multifunctional landscapes and the policy aspects of GP8 (policy options and incentive mechanisms for strengthening Agroforestry).

There are changes in the project outputs following the Centre's new Research Strategy 2008–2015. The three previous output areas GP3.1 (improved Agroforestry management principles, methods and options developed for improved Agroforestry management, including their ecological impacts on smallholder farms), GP3.2 (knowledge options developed for improved water productivity and use in Agroforestry systems including trade-offs at the farm level) and GP3.3 (knowledge of opportunities developed and promoted for Agroforestry to improve agricultural productivity and create greater system resilience and alternatives for income generation within smallholder farms) were consolidated into two outputs, GRP2.1 (knowledge enhancing the understanding of the costs, benefits and risks of Agroforestry technologies and systems under varying conditions developed) and GRP2.2 (knowledge options and Agroforestry management principles, methods and practices for improved tree and Agroforestry management developed, including water productivity and use in Agroforestry systems and trade-offs at farm level).

GRP2 will focus on the farm-scale interactions between trees and livelihoods, in between the tree germplasm quality issues, selection and participatory tree domestication work including biofuels of GRP1, the market forecasting and market chain analysis including certification systems value chain aspects of GRP3, the dynamics and drivers of land use change and rehabilitation of degraded lands of GRP4, and

the landscape-scale interactions of GRP6. Adaptation and vulnerability to climate change with GRP5 is a cross-cutting area and will be closely linked to GRP2 as a part of the context for Agroforestry systems research. The work conducted in GRP6 on policies and environmental services will be in part informed by GRP2 outputs.

Description (Output Level)

GRP2.1: Enhanced the better understood costs, benefits and risks of Agroforestry technologies and systems under varying conditions

GRP2.1 addresses specifically the role of Agroforestry in enhancing the performance of smallholder farming systems by increasing the productivity of associated crop and livestock systems, enhancing water use efficiency by trees, leading to more diverse production systems and generating income through medium- and high-value tree products. Prime examples of how Agroforestry can contribute to rural livelihoods include rubber-based Agroforestry systems in Southeast Asia and West Africa, shea and baobab tree-based parklands in West and Central Africa, cacao production system in West Africa and Southeast Asia, coffee systems in Latin America, Africa and Southeast Asia and smallholder timber production in all three continents, especially where accessible forest resources have been depleted. There are also vast opportunities for Agroforestry to have wider poverty reduction impacts through market-driven and locally led tree cultivation systems, but these openings are not well understood by policy makers and shapers, development planners, researchers and donors. Hence, there is need for more research to demonstrate the existing use and impacts of these systems.

Partners contributing to GRP2.1 include:

- ◆ CGIAR centres: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), IITA, ILRI, International Center for Tropical Agriculture (CIAT).

- ◆ Advanced research institutes (ARIs) and other centres: CIRAD, International Centre of Insect Physiology and Ecology (ICIPE).
- ◆ UN institutions: FAO and partners (Sahel Eco).
- ◆ Universities: University of Hohenheim (Germany); Ghent University (tree diversity on farm); University of Copenhagen (Fruit trees on farm in WCA/Sahel), Bogor Agricultural University, Indonesia; University of Malawi.
- ◆ National agricultural research systems (NARS) representing national agriculture, forestry and livestock research.
- ◆ Local governments and NGOs.
- ◆ Common Fund for Commodities (CFC), International Fund for Agricultural Development (IFAD).
- ◆ Australian Centre for International Agricultural Research (ACIAR).
- ◆ Private companies: Mars Inc.

GRP2.2: Principles, methods and practices developed for improved tree and Agroforestry management

GRP2.2 addresses the need to understand the principles of managing integrated systems and the synergies or trade-offs between improved economic returns, short-term market production, pest and diseases risks and long-term sustainability of the systems. The costs, benefits and risks of such intensified and diversified systems have to be understood.

Partners contributing to GRP2.2 include:

- ◆ CGIAR centres: International Water Management Institute (IWMI), ICRISAT, IITA, ILRI, Bioversity International, Tropical Soil Biology and Fertility Institute (TSBF).
- ◆ ARIs and other centres: ICIPE
- ◆ UN institutions: FAO and partners (Sahel Eco).
- ◆ Universities: University of Hohenheim (Germany); Ghent University (tree diversity on farm); University of Copenhagen (Fruit trees on farm in WCA/Sahel), Bogor

Agricultural University, Indonesia; University of Malawi.

- ◆ NARS representing national agriculture, forestry and livestock research.
- ◆ Local governments and NGOs.
- ◆ Water productivity and use partners (FAO, IWMI, Rainwater Partnership, International Rainwater Catchment Systems Association, Southern and Eastern Africa Rainwater Network (SEARNET), International Rainwater Harvesting Alliance).
- ◆ CFC, IFAD.
- ◆ Private companies: Mars Inc.

Alignment to CGIAR Priorities (Output Level)

Both GRP2.1 and GRP2.2 align to CGIAR System Priorities:

3A: Increasing income from fruits and vegetables

3D: Sustainable income generation from forests and trees

4C: Improving water productivity

4D: Sustainable agro-ecological intensification in low and high-potential areas

5D: Improving research and development options to reduce rural poverty and vulnerability

Countries of Planned Research (Output Level)

GRP2.1 and GRP2.2 work is applicable to all regions where the Centre is working including the Latin America region, but the priority countries are: Burkina Faso, Guinea, Mali, Niger, Nigeria and Senegal, Kenya, Uganda, Malawi, Cameroon, DR Congo, Ethiopia, Rwanda, Burundi, Lesotho, Angola, Madagascar, Tanzania, India, Nepal, Sri Lanka, Bangladesh, Laos, Indonesia, Thailand, Philippines, Vietnam and China.

Impact Pathways by Output

Outputs	Outcomes	Impacts
GRP2.1: Knowledge enhancing the understanding of the costs, benefits and risks of Agroforestry technologies and systems under varying conditions developed.	<ul style="list-style-type: none"> Development programmes for smallholder farmers include Agroforestry management options among intervention choices they consider, and use improved tools and knowledge to make more informed choices on integrating Agroforestry into farming systems. 	Transformation of lives and landscapes through widespread adoption of Agroforestry systems that increase farm-level productivity, incomes, food security and water productivity, and protection of the environment on tropical smallholder farms.
GRP2.2: Knowledge options and Agroforestry management principles, methods and practices for improved tree and Agroforestry management developed, including water productivity and use in Agroforestry systems and trade-offs at farm level.	<ul style="list-style-type: none"> Smallholder farmers enhance intensified and diversified farming systems with more water efficient, productive and sustainable tree-based options. Researchers targeting Agroforestry systems for smallholder farms have access to and use improved methods of system analysis, experimentation and support of farmer-level learning, as well as information critical for adjusting research agendas. Smallholder farmers across the tropics maintain and enhance intensified and diversified farming systems with more productive and sustainable tree-based options for the supply of products for local use and markets, and the provision of local services. Improved Agroforestry management options, smallholder farmers reduce their vulnerability to impacts of disasters and enhance their ability for speedy recovery. 	

Target ecoregions

1. Sub-Saharan Africa

RAEZ 1 Warm arid and semi-arid tropics: West Africa (Burkina Faso, Guinea, Mali, Niger, Nigeria and Senegal).

RAEZ 2 Warm sub-humid tropics: East Africa (Kenya and Uganda); Southern Africa (Malawi).

RAEZ 3 Warm humid tropics: Cameroon, DR Congo, Ethiopia, Kenya and Rwanda.

RAEZ 4 Cool tropics: Burundi, Lesotho, Rwanda, and parts of Angola, Ethiopia, Kenya, Madagascar and Tanzania.

2. Asia and the Pacific

RAEZ 8 Warm arid and semi-arid tropics (AEZ1): India.

RAEZ 9 Warm sub-humid tropics (AEZ2): India and Nepal and Sri Lanka.

RAEZ 10 Warm humid tropics (AEZ3): Bangladesh, Laos, Indonesia, Thailand, Philippines, Vietnam and South West China.

GRP2 will collaborate with the reformulated AHI and Alternative to Slash-and-Burn (ASB) Partnership for the Tropical Forest Margins in evaluating impacts and trade-offs of farming systems. It also works closely with Program 4 'Poverty alleviation and sustainable management of water, land and forest resources' of the CGIAR MTP for West and Central Africa.

Beneficiaries and End Users

Knowledge to action of this global research priority will involve collaboration with national/regional, technical agencies, e.g. commodity research agencies NARIs, NGOs, CBOs; policy shapers and makers (national commodity boards); producer cooperatives and associations; certification agencies; private sector bodies; media institutions; education institutions (universities, colleges etc.); water harvesting networks; governments institutions.

International Public Goods

Through this global project, World Agroforestry Centre will focus more on understanding the constraints and opportunities at larger scales

(and not about individual farmer circumstances) such as major farming systems to be able to set priority research and development agendas in the development of productive Agroforestry systems for smallholders. World Agroforestry Centre is well placed to deliver IPGs based on their experience in analysing lessons learnt on systems, strategies, approaches and methods for increasing agricultural productivity.

This global project will focus on developing principles and strategies for improving farming systems through tree diversification and intensification, and on identifying the attributes of species that can play useful functional roles while protecting the environment on farm. It will also invest in the development of tools, databases, simulation models, guidelines, maps, practices and materials that regional, national and local researchers and development practitioners can use to help identify Agroforestry solutions appropriate to their respective conditions. Moreover, the information on the management, water use and productivity of various exotic and indigenous tree species occurring on farm in various tropical sites have a critical IPG value as diverse natural and traditional farming systems are replaced by monoculture systems at very high rates in many agricultural systems.

Beyond research, this GRP will be an advocate for national policies that facilitate the adoption and adaptation of new and integrative approaches. GRP2 will also be involved in capacity building of scientists from key institutions on research approaches/methods and principles of Agroforestry in its specific area of expertise. The public will also be better informed about trade-offs, costs and risks and synergies between ecological and economical benefits of growing different mixtures of tree species within farming systems for their improved livelihoods and sustainable environment.

Elaboration of Partners' Roles

The GRP will collaborate with the following key institutions as per their respective expertise contributing to the project outputs:

- CGIAR centres: IWMI, ICRISAT, IITA, ILRI, Bioversity International, CIAT, TSBF.
- ARIs and other centres: CIRAD, ICIPE.
- UN institutions: FAO and partners (Sahel Eco).
- Universities: University of Hohenheim (Germany); Ghent University (tree diversity on farm); University of Copenhagen (Fruit trees on farm in WCA/Sahel), Bogor Agricultural University, Indonesia; University of Malawi.

- NARS representing national agriculture, forestry and livestock research.
- Local governments and NGOs.
- Water productivity and use partners (FAO, IWMI, Rainwater Partnership, International Rainwater Catchment Systems Association, SEARNET, International Rainwater Harvesting Alliance).
- CFC, IFAD.
- Private companies: Mars Inc.

More partnerships and cross linkages need to be further developed with foundations such as Bill & Melinda Gates Foundation.

The following table shows the strategic roles of different partners:

Name of Partner	What they will do	Output	Geographical scope
ICRISAT	Assist in improved water productivity and diversifying agriculture into high-value crops in the drylands.	GRP2.1 & GRP 2.2	Global
IITA	Provide expertise in developing methods and tools for creating greater system resilience and alternatives for income generation within smallholder farming systems.	GRP2.1 & GRP 2.2	Global
Bioversity International	Offer expertise on methods of assessing and <i>in situ</i> conservation of the agro-biodiversity for developing strategies of tree genetic conservation on small farms within diversified farming systems.	GRP 2.2	Global
IWMI	Collaborative research in improved water productivity in Agroforestry systems and upgrading rainfed agriculture at basin level.	GRP 2.2	Global
CIRAD	Give expertise on some tree-based farming systems such as coffee, cocoa and palm oil would facilitate analysing the potential to integrate Agroforestry in smallholder high-value tree crop systems, and assess various values and trade-offs of such systems.	GRP2.1	Global
TSBF	Provide expertise on nutrient cycling and soil fertility issues.	GRP 2.2	Global
CIAT	Assist in assessing constraints and opportunities of Agroforestry systems for improved food security.	GRP2.1	Southern Africa
ILRI	Assisting the integration of fodder trees and shrubs into livestock systems particularly at farm level.	GRP2.1 & GRP2.2	Global

Name of Partner	What they will do	Output	Geographical scope
Universities: University of Hohenheim (Germany); Ghent University (Belgium); University of Copenhagen (Denmark), Bogor Agricultural University (Indonesia); University of Malawi (Malawi), Mzuzu University (Malawi) and University of Zimbabwe.	Assisting in the research of various aspects on the adoption and impact of integrating indigenous fruit trees, medicinal and pesticidal plants on small farms; and assessing tree diversity on farm; research tools and methods and results mainstreamed into university curricula.	GRP2.1 & GRP2.2	Southeast Asia, West and Central Africa and Southern Africa
FAO; Sahel Eco	Approaches in market analysis for non-forestry products and taking the developed science and technologies to beneficiaries at multiple levels.	GRP2.1 & GRP2.2	West and Central Africa
Coffee Network (CAFNET)	Participate in the assessment of coffee-based Agroforestry systems in East Africa.	GRP2.1 & GRP2.2	Eastern Africa
Local government and NGOs	Participate and facilitate action research and extension of new technologies to farmers and field workers, and policy/decision makers; scaling up of research output; facilitation in policy review and improvements.	GRP2.1 & GRP2.2	Southeast Asia, West and Central Africa
Water productivity and use partners: Rainwater Partnership, International Rainwater Catchments Systems Association (IRCSA), SEARNET	Rainwater Partnership participates in lobbying for policy support and assist in fundraising for scaling up water efficient and productive Agroforestry. IRCSA shall provide science knowledge and experiences on performance of rainwater catchment systems. SEARNET will assist in identifying research fellows, testing research water harvesting (RWH) innovations, documentation and dissemination of research findings.	GRP 2.2	Global Global Eastern and Southern Africa
CFC, ACIAR, SANREM CRSP	Providing resources for research on economical cultivation on smallholdings through adoption of improved technologies and diversified farming systems	GRP2.1 & GRP2.2	West Africa, Southeast Asia
IFAD	Resources for research on food security and poverty alleviation, including tree cultivation, marketing strategies for non-forest products on farms, strengthening livelihood strategies; facilitating adoption/adaptation of research output in their development projects.	GRP2.1 & GRP2.2	Global
Mars Inc.	Providing resources and intelligence for research on the cultivation and trade of cocoa.	GRP2.1 & GRP2.2	West and Central Africa
ACIAR	Resources for the cultivation of teak on small farms.	GRP2.1	Southeast Asia

Global Research Project

3: Improving tree product marketing for smallholders

Project Overview and Rationale

Project Goal

To increase smallholder benefits in Agroforestry tree product and service value chains by improving their marketing systems.

Project Objective

GRP3 aims to enhance smallholders' access to Agroforestry tree product value chains, and to improve marketing strategies and market performance for increased incomes and improved livelihoods.

Rationale

GRP3 addresses problems faced by two different sets of actors. First, small-scale farmers and entrepreneurs lack business skills, have limited access to Agroforestry tree product markets, and have little available information on market demand. They are poorly organized and lack assured and stable markets. It is therefore not surprising that they face high marketing risks and costs, and earn low returns from marketing their tree products.

The second set of actors, government and non-governmental organizations seeking to facilitate smallholder marketing, also face critical problems. There are few tools available to assess market opportunities, or to help farmers exploit available opportunities like adding value to products from the farm. These facilitating organizations also find that there are few market demand assessments and few business investment models for tree product investors.

To make matters worse, both sets of actors face problems in the enabling environment that act as disincentives to marketing produce. The inadequate institutional support for marketing (e.g. credit, market information) and skewed policies, barriers and disincentives make

it difficult for smallholders to market their produce. There is an absence of certification standards, and associated premiums for Agroforestry tree products. Trade for some products is over-regulated (e.g. on-farm timber) while in other cases it is under-regulated (e.g. herbal medicines). Many policy makers still view private traders as a parasitic class rather than as a resource that can generate wealth in rural areas. Also, they do not often perceive the potential for tree products to generate significant incomes for smallholder farmers.

GRP3 has two research outputs:

GRP3.1: Approaches for improving smallholder access to tree product value chains developed.

GRP3.2: Improved marketing strategies to enhance the performance of tree product value chains and smallholder livelihoods.

Alignment to CGIAR Priorities (Project Level)

The project objectives align well with CGIAR system priorities: GRP3.1 will improve the access of smallholders to fruit and tree product value chains and GRP3.2 will promote sustainable income generation from fruits and tree products thus aligning with system priorities 3A (increasing income from fruit and vegetables) and 3D (sustainable income generation from forests and trees). Research in both outputs will focus on how the poor, women, and other vulnerable groups can participate in and benefit from tree product value chains and thereby help make markets work for the poor thus aligning with system priority 5B (making international and domestic markets work for the poor). This research will also directly contribute to system priority 5D (improving options to reduce rural poverty and vulnerability). Capacity enhancement for the poor and for those institutions helping the poor is also critical for ensuring that markets work for the poor. Finally, the research in both outputs will help develop and improve rural institutions and their governance thus aligning with system priority 5C (rural institutions and their

governance). The most important institutions in this regard are farmer associations, which can play important roles in both improving smallholder access to value chains and in improving incomes and sustainable livelihoods. Other key institutions to be improved include commodity exchanges, private companies providing business development services, and local governments.

Outputs Description

Changes from previous MTP

The project title, outputs, and research questions have changed considerably since last year for several reasons. First, the project had just started last year when the MTP was drawn up. Therefore, the MTP was developed on the basis of too few ideas and experiences. Since that time, considerable consultation has been done within World Agroforestry Centre and with a wide range of partners. The new outputs and research questions thus build on the views and experiences of a wide range of actors and a careful analysis of research capacities and opportunities. In the last MTP, our outputs were generic: diagnosing problems, developing solutions, and building capacity (GP4.1, 4.2 and 4.3). In this MTP, GRP3.1 focuses on a key issue in marketing, smallholder access to markets and how to enhance it while GRP3.2 focuses on a key issue in marketing, developing strategies to enhance the performance of tree product value chains for improving smallholder *livelihoods*.

Description (Output level)

GRP3.1: Approaches for improving smallholder access to tree product value chains developed

Description

The development of approaches for improving smallholder access to tree product value chains focuses on three research issues:

- How and under what circumstances can certification help the poor? How can the poor gain better access to certified markets? The demand for certified products is rising rapidly, offering poor farmers potentially

high returns. But research is needed to assess how farmers can access these high-return enterprises. Our research compares and analyses three certification opportunities for farmers, eco-certified jungle rubber in Indonesia, shea products in the Sahel, and shade coffee in East Africa.

- How can collective action improve farmers' access to markets, enhance livelihoods and help market performance (e.g. outgrower schemes)? What are the drivers and triggers, and how can barriers be overcome? Collective action can help farmers sell produce in bulk, solving a key constraint that smallholders face in marketing their produce. Collective action also helps farmers to reduce input costs, access external assistance, and foster learning and experimentation. Our research focuses on the role of farmer groups in improving market access and how Land Care, farmer organizations for promoting sustainable farming and livelihoods, can improve market access. Areas of research are East Africa and Southeast Asia.
- What key factors contribute to effective linkages between farmers and the private sector? How do they vary over space, time, and product type? Here we test approaches for implementing public private partnerships and how to build trust and market arrangements that are mutually beneficial for both smallholders and private enterprises.

Key partners include the Coffee Research Foundation, Kenya, Coopérative pour la Promotion des Activités Café (Rwanda), the Rwanda Coffee Office, Kunming Institute of Botany, Yunnan (China), National Agricultural Research Organization (Uganda), Land Care Australia, and Unilever Ltd.

GRP3.2: Improving marketing strategies to enhance the performance of tree product value chains and smallholder livelihoods

Our research focuses on four strategies for enhancing value chain performance and improving livelihoods:

- Under which circumstances is it better to help farmers capture a bigger portion of the value chain or to more effectively link them to traders and agribusinesses for marketing their produce? The answer depends on a range of factors: product characteristics, farmer capacities, resource availabilities, and social capital. Guidelines and decision support tools can help facilitating agencies to make informed decisions so as to help farmer organizations to market products in the most beneficial manner. We are conducting research in this area on fruits in Central and Southern Africa.
- Can vouchers and other innovations help strengthen private seed and seedling markets? Instead of receiving seedlings for free, farmers exchange a ticket (voucher) for seedlings from nursery owners; the nursery owner then receives compensation for the voucher from a project. This system helps promote private supply systems, in that the farmer gets used to procuring seedlings from the nursery and private nurseries are supported instead of project nurseries. We will test the system at three sites in Cameroon, Malawi, and Kenya.
- What are the best practices for equitable and effective farmer enterprises, considering issues of social stratification, gender and economic differentiation? Key social factors include gender, age, ethnicity, and religion while economic factors include income, assets and decision making. Best practices are being assessed in Central Africa.
- How can organizations and entrepreneurs decide which enterprises are most viable in their area? How can models be used to assess *ex ante* feasibility and profitability of

such enterprises? We are developing a model to assess the feasibility of leaf meal enterprises for marketing fodder; such enterprises are very common in Asia but are found at only one site in Kenya. The model will be tested in Mali and in Rwanda.

Alignment to CGIAR System priorities (Output level)

GRP3.1 aligns with CGIAR System Priorities:

3A: Increasing income from fruits and vegetables

5B: Making international and domestic markets work for the poor

5C: Rural institutions and their governance

5D: Improving research and development options to reduce rural poverty and vulnerability

GRP3.2 aligns with CGIAR System Priorities:

3A: Increasing income from fruits and vegetables

3D: Sustainable income generation from forests and trees

5B: Making international and domestic markets work for the poor

5C: Rural institutions and their governance

5D: Improving research and development options to reduce rural poverty and vulnerability

Impact pathways by Outputs

GRP3.1

Key outcomes of this output include increased smallholder access to and participation in more cohesive and sustainable farmer organizations, more effective public-private partnerships, and better targeting of certification interventions to smallholders, the rural poor and women. These in turn will lead to increased marketing, better negotiating power, and higher prices, which will all help smallholders to improve their livelihoods.

Main users include organizations facilitating improved smallholder access to markets including NGOs, government extension services, policy makers and farmer organizations trying to help their members. Outputs will be written up in the form of guidelines, manuals and policy briefs and capacity building of staff of the facilitating organizations will be an important

means of communicating the findings. Other key audiences include private corporations seeking to increase tree product marketing and certification bodies seeking to benefit the poor. In addition to distributing manuals and guidelines to them and conducting capacity building events, we will also communicate our findings directly to such groups via workshops and consultations.

Target ecoregions

1. Sub-Saharan Africa

RAEZ 1 Warm arid and semi-arid tropics (AEZ1): Mali.

RAEZ 3 Warm humid tropics (AEZ 3): Cameroon.

RAEZ 4 Cool tropics (AEZ 4): Kenya, Uganda and Rwanda.

2. Asia and the Pacific

RAEZ 10 Warm humid tropics (AEZ 3): Indonesia and the Philippines.

GRP3.2

Our main outcomes include stronger linkages between smallholders and the private sector, improved policies to support smallholder marketing and enterprises, more effective farmer organizations, more numerous and more equitable, profitable and sustainable farmer enterprises, including nurseries. Other outcomes include improved representation of smallholder associations in policy making, strengthening of the private sector in seed/seedling marketing, and enhanced entrepreneurial capacity building among partner organizations such as NGOs and government extension services. These will help farmers improve the prices they receive, reduce transactions costs, improve their incomes and enhance sustainable livelihoods.

Main users include organizations facilitating farmer enterprises including NGOs, government extension services, policy makers and farmer organizations trying to help their members. Outputs will be written up in the form of models, guidelines, manuals, and policy briefs

and capacity building of staff of the facilitating organizations will be an important means of communicating the findings. Other key audiences include private corporations seeking to increase tree product marketing. In addition to distributing manuals and guidelines to them and conducting capacity building events, we will also communicate our findings directly to such groups via workshops and consultations.

Target ecoregions

1. Sub-Saharan Africa.

RAEZ1 Warm arid and semi-arid tropics (AEZ1): Mali.

RAEZ2 Warm subhumid tropics (AEZ2): Malawi.

RAEZ 3 Warm humid tropics (AEZ 3): Cameroon.

RAEZ 4 Cool tropics (AEZ4): Kenya and Rwanda.

2. Asia and the Pacific

RAEZ 10 Warm humid tropics (AEZ3): Indonesia.

International Public Goods

Some key international public goods to be produced by the project include:

- Decision support tools to help farmer groups and organizations decide whether and how a certification scheme can benefit smallholders.
- Decision support tools to assist facilitating agencies and farmer organizations decide whether to seek value adding activities or to link with private sector operations that do so.
- Guides for government and non-governmental organizations to facilitate the establishment and effectiveness of farmer groups and associations; best institutional innovations for collective marketing.
- Conceptual framework and decision support tools for guiding different types of partnerships, such as public-private partnerships, and assessing trade-offs among options.

- Diagnostic and analytical tools for identifying market opportunities and assessing the performance of Agroforestry tree product value chains.
- Guidelines on the use of vouchers to promote effective private sector seedling supply systems.
- A synthesis of the impacts of different types of farmer enterprises on community structures.
- Publication on best practices for equitable and effective farmer enterprises, considering issues of social stratification, gender and economic differentiation.
- Model for assessing the viability of leaf meal enterprises in different locations in Africa.

Additional IPGs beyond research include:

Action research:

- Assisting small-scale seed vendors and nursery operators to form associations so as to assess the advantages and disadvantages of such associations and generate lessons (IPGs) for promoting them.
- Assisting small-scale seedling vendors to market seedlings using vouchers, in order to test the advantages and disadvantage of this system relative to other approaches.

Capacity building: Conducting training courses and developing training curricula assists in disseminating best practices and assuring that lessons and international public goods are disseminated to a wide range of partners as well as to teachers and students in educational institutions.

Development-support: Facilitating the dissemination and use of training materials and decision-support tools by beneficiaries and end users.

Elaboration of Partner roles

We seek to strengthen the science and practice of Agroforestry tree product marketing based on the guidance of a centre-commissioned external review (CCER) on marketing and the Centre's third EPMR. We envision strengthening our teams through working more closely with partners. We

have already initiated partnerships with national public institutions in Southern Africa and South Asia. At the international level, we will work with certification bodies, ARIs, and international NGOs (e.g. Landcare, Technoserve). Our main CGIAR partners are International Food Policy Research Institute (IFPRI), ICRISAT, CIFOR, and the Collective Action and Property Rights Initiative. At the national and local level, we work with agricultural research institutions (NARS), universities, NGOs (including micro-finance institutions), CBOs, private businesses and farmer associations.

Key partners with whom we conduct collaborative research on certification include the Coffee Research Foundation, Kenya, the Rwandan Coffee Office, and the Coopérative pour la Promotion des Activités Café (Rwanda) in East Africa. The Kunming Institute of Botany, Yunnan (China) is collaborating on shea product research, conducting laboratory analyses of shea products. Concerning collective action, key partners include National Agricultural Research Organization (Uganda) and Land Care International. On public-private partnerships, Unilever Ltd. and SNV (Netherlands) are key partners.

On issues of adding value vs. linking with private sector, we work with Bunda College of Agriculture and Dariboard Ltd. in Malawi, and with IFPRI, Technoserve and Sunny Industries in Kenya. On vouchers, our main research partner is ICRISAT. On equitable enterprises, we work with Tschang University of Agriculture (Cameroon) and with CIFOR. On models for assessing the viability of leaf meal, we work with the Institut de l'Economie Rurale in Mali and the National University of Rwanda.

Presently, at the multinational private sector level we work with Unilever, Mars Inc., AAK and ITC, and expect other private sector actors and policy makers to use our tools for improving linkages with farmers and certification bodies, and to adopt recommendations for increasing smallholder access.

Global Research Project 4: Reducing land health risks and targeting Agroforestry interventions to enhance land productivity

Project Overview and Rationale

Project Objectives

GRP4's objectives are to:

1. Develop multiscale and widely usable land health surveillance methods that can provide information on where land problems exist and where the major risks are.
2. Quantify and map these major risks to land health in the tropics, target land management and Agroforestry interventions to reduce and reverse these risks at different scales, and evaluate the cost-effectiveness and outcomes of intervention programmes.
3. Develop national capacity in operational land health surveillance methods and tools.

Rationale

Land degradation is a global threat to habitat, economy and society, and is the overarching environmental issue of concern in Africa, threatening food security, ecosystems and livelihoods. Soil degradation and fertility decline is a major concern for food security in developing countries. However, current measurement and information systems on land degradation in developing countries are grossly inadequate for the task of planning and evaluating land health¹ and Agroforestry policy and practice. In particular, there is a lack of systematic data on land health risks to enable efficient targeting of land management and Agroforestry interventions² and to answer questions such as:

- What are the socioeconomic and biophysical determinants of land degradation (land health risks) how are they geographically distributed?
- How much future land degradation can be avoided or reversed through targeted action to reduce risks?
- What is the cost efficiency of preventative and rehabilitation Agroforestry intervention programmes under different conditions?

GRP4 has two research outputs:

GRP4.1: Effective land health surveillance methods developed.

GRP4.2: Land health risks assessed and Agroforestry interventions to reduce and reverse land degradation well targeted.

Alignment to CGIAR priorities (Project Level)

GRP4 matches most closely with CGIAR System Priorities 4A (integrated land water and forest management at landscape level) and 4D (sustainable agro-ecological intensification in low- and high-potential environments). Primary contributions to 4A will be to develop methods and analytical tools for the management of multiple use landscapes with a focus on sustainable productivity enhancement (Goal 1); and enhance stakeholder capacity for socio-ecological planning at landscape and farm levels (Goal 2). Primary contributions to 4D will be to improve understanding of degradation thresholds and irreversibility and the conditions for success in low productivity areas (Goal 1); identify domains of potential adoption and improvement of technologies for improving soil productivity, preventing degradation, and rehabilitating degraded lands (Goal 3); and to improve soil quality to sustain increases in productivity, stability, and environmental services through greater understanding of processes that govern soil quality and trends in soil quality in intensive systems (Goal 5).

¹ Land health is the capacity of land to sustain delivery of essential ecosystem services (the benefits people obtain from ecosystems). Ecosystem services are defined by the Millennium Ecosystem Assessment.

² Intervention means any promotive, preventive, curative, or rehabilitative activity where the primary intent is to improve land health and human well-being. GRP4 focuses on targeting and evaluations of programmatic interventions (as distinct from individual technology interventions)

Outputs Description

Changes from Previous MTP

GRP4 is a revision of the former GP6: (Agroforestry for land rehabilitation) and is designed to consolidate the Centre's progress in concepts and methods for land health surveillance and their application to targeting and evaluating Agroforestry interventions. The new project focus is shifted to emphasize assessing risks to land degradation and targeting preventive interventions to reduce these risks in addition to the prior emphasis on targeting Agroforestry for land rehabilitation.

Description (Output Level)

GRP4.1: Effective land health surveillance methods developed

Recent World Agroforestry Centre research advances in land health surveillance³ are based on principles adapted from public health surveillance, where accurate measuring and monitoring of changes and improvements in the health of populations is closely integrated with statistical methods to form a scientific basis for policy development, priority setting and management. GRP4.1 builds on these advances and tackles the key methodological question: How can land health surveillance systems deploy modern science and technology to strengthen evidence-based decision making on land and Agroforestry management at multiple scales, to help better (i) understand hazardous and protective factors affecting land health risk, (ii) target Agroforestry options, (iii) allocate resources and set priorities, and (iv) learn through quantitative monitoring and impact assessment?

GRP4.1 primarily contributes to CGIAR Priority 4A through the development of methods and analytical tools for the management of multiple use landscapes with a focus on sustainable productivity enhancement (Goal 1).

³ The ongoing, systematic collection, analysis, and interpretation of data essential to the planning, implementation, and evaluation of land management policy and practice, and application of these data to the promotion, protection, and rehabilitation of land and ecosystem health. A surveillance system includes a functional capacity for data collection, analysis, and dissemination linked to land health programmes

GRP4.2: Land health risks assessed and Agroforestry interventions to reduce and reverse land degradation well targeted

Through application of the land health surveillance methods, GRP4.2 aims to address the following research questions:

1. What are the main environmental and behavioural⁴ risk factors associated with land and soil degradation syndromes in the tropics, and how are they distributed in relation to different settings and factors such as ecoregions and poverty levels?
2. What types of Agroforestry interventions can help reduce or reverse key risk factors associated with land degradation and what are the cost efficiencies of alternative preventative and rehabilitation interventions under different circumstances?

GRP4.2 primarily contributes to CGIAR System Priority 4D by improving understanding of degradation thresholds and irreversibility and the conditions for success in low productivity areas (Goal 1); identifying domains of potential adoption and improvement of technologies for improving soil productivity, preventing degradation, and rehabilitating degraded lands (Goal 3); and improving soil quality to sustain increases in productivity, stability, and environmental services through greater understanding of processes that govern soil quality and trends in soil quality in intensive systems (Goal 5).

Alignment to CGIAR priorities (output level)

GRP4.1 aligns with CGIAR System Priority:

4A: Integrated land, water and forest management at landscape level.

GRP4.2 aligns with CGIAR System Priority:

4D: Sustainable agro-ecological intensification in low- and high-potential environments

⁴ Risk factors are attributes that are associated with an increased probability of a specific land health problem or outcome. Risk factors include biophysical and socioeconomic factors or exposures, and include behavioural as well as inherent characteristics. Protective and hazardous risk factors are also considered

Countries of Planned Research (Output Level)

For both GRP4.1 and GRP4.2 the countries are:

Mali, Mauritania, Niger, Senegal, Burkina Faso, Ethiopia, Kenya, Tanzania, Uganda, Madagascar, Malawi, Mozambique, Zambia, Ethiopia, Rwanda, India and Brazil.

Impact pathways by outputs

GRP4.1

We expect that governments will take up the land health surveillance methods as an integral part of land management planning and practice. This assumes investments by governments in new soil analytical equipment, geoinformatic facilities and staff capacity in associated quantitative techniques. The project will play a key role in building capacity of tropical developing countries in modern scientific and technical approaches and tools for land assessment and management, e.g. geoinformatics and associated statistical analysis. Training and capacity building is needed to support a new generation of soil scientists and natural resource management (NRM) professionals to ensure that the generated information can be used to improve land management and policy decision-making. The benefits of application of these methods by national programmes are summarized in GRP4.2.

The IPGs envisaged by GRP4.1 include: land health surveillance approaches, methods, standards, tools and protocols; and capacity building in land health surveillance methods. Examples include new scientific concepts for evidence-based assessment of risk factors associated with land degradation, methods for low cost, rapid soil analysis using infrared spectroscopy, and new statistical methods for digital mapping of land degradation and soil health that link ground observations to remote sensing information.

External partnerships include ARIs such as the Earth Institute and Center for International

Earth Science Information Network (CIESIN) at Columbia University and BioForsk in Norway on methods development in remote sensing, cyber infrastructure and biometrics; and national soil survey institutes and universities in Africa for capacity building in land health surveillance methods. The project is also working closely with the United Nations Environment Programme (UNEP), United Nations Development Program (UNDP), the World Bank, and the New Partnership for Africa's Development (NEPAD) on integrating research and assessment methods into major land management programmes, such as TerrAfrica. Institutions helping to test and further develop soil-testing methods using infrared spectroscopy include Egerton, Jomo Kenyatta and Nairobi universities in Kenya, National Agricultural Research (IIAM) in Mozambique, and Institut d'Economie Rurale (IER) in Mali. The same national research organizations and ministries of agriculture also help with land health surveillance (GRP4.2). The private sector works with the project on new technological developments, such as low cost infrared spectrometers for soil analysis in developing countries. For example Bruker Optics (Germany) is providing technical support to World Agroforestry Centre's network of near-infrared spectroscopy laboratories in Africa and the development of high throughput mid-infrared soil analysis.

The primary geographic focus of GRP4.1 will be in sub-Saharan Africa, and then extending this work into developing countries in Asia and Latin America as follows:

1. Sub-Saharan Africa

RAEZ 1 Warm arid and semi-arid tropics (AEZ 1): West Africa: Mali, Mauritania, Niger, Senegal, and parts of Burkina Faso. East Africa: Parts of Ethiopia, Kenya, Tanzania and Uganda. Southern Africa: Parts of Madagascar, Malawi, Mozambique, and Zambia.

RAEZ 2 Warm subhumid tropics (AEZ 2): Southern Africa: Parts of Malawi, Mozambique and Zambia.

RAEZ 3 Warm humid tropics (AEZ 3): Parts of Kenya and Ethiopia.

RAEZ 4 Cool tropics (AEZ 4): Rwanda, and parts of Ethiopia, Kenya, Madagascar and Tanzania.

2. Asia and the Pacific

RAEZ 8 Warm arid and semi-arid tropics (AEZ 1): Parts of India.

RAEZ 9 Warm subhumid tropics (AEZ 2): Parts of India.

3. Latin America and the Caribbean

RAEZ 17 Warm humid tropics (AEZ 3): Brazil.

GRP4.2

Improved information on land health risks and spatial targeting of Agroforestry interventions is expected to guide intervention priorities at a range of spatial scales. Better land health policy and management in turn results in healthier ecosystems through the enhancement of environmental services on the landscape, and improved rural livelihoods in developing countries through sustainable and productive management of agricultural landscapes.

Regional scale: Policy development, priority setting and resource allocation decisions on land and soil management programmes by inter-governmental organizations, UN agencies, donors, non-governmental development agencies, and the private sector.

National scale: Policy development, priority setting and resource allocation decisions on land management programmes by governments and development agencies.

Local scale: Design of local extension and development programmes and targeting of land management recommendations to farmer communities by government local planners and extension services.

The main assumption is that national programmes and donors see the value of adopting scientific and systematic approaches to targeting land

management intervention programmes and that they invest in developing sufficient scientific and technical capacity in national programmes for science-based land management. There is increased interest in addressing land degradation and soil fertility problems in tropical developing countries, especially in Africa with the launch of TerrAfrica, Alliance for a Green Revolution in Africa (AGRA) and other initiatives. Demonstrating the value of land health surveillance information for sustainable development is also an important objective of this project.

The land health surveillance system is modelled on surveillance approaches used in public health management. At present there are no consistent, large-area mechanisms for testing the efficacy of Agroforestry and other land management interventions in tropical developing countries. The project will (i) enable governments to provide practical, timely, and cost effective information at high spatial resolution about where specific land degradation processes occur in a given region or country, and how these are changing over time, (ii) provide a framework for rigorous scientific testing and implementation of locally relevant preventative and rehabilitative soil management interventions, addressing what works where, and (iii) provide practical policy and management advice to policy makers, scientists, development specialists and farmers. The approaches and methods are globally applicable but have greatest potential to accelerate development progress in tropical developing countries, where data on land condition and knowledge on appropriate targeting of land rehabilitation interventions are completely inadequate for the task at hand.

International public goods from GRP4.2 include: land health risk assessments at multiple scales; spatial targeting and evaluation of Agroforestry interventions in relation to major land degradation problems; and co-development of an Africa Soil Information System. World Agroforestry Centre's comparative advantage is in

application of infrared spectroscopy methods to large area land health assessment and systematic ground survey of land health risk factors linked to remote sensing and other geoinformatics, and the application of this data to spatial targeting and evaluation of Agroforestry programmes. The land health surveillance framework is being used in a UNEP capacity-building project to guide strategies for land restoration in five West African dryland countries and in a World Bank-Global Environment Facility (GEF) project in Kenya, led by the Kenya Agricultural Research Institute, which is designed to tackle land degradation problems in the Lake Victoria basin. Soil health surveillance has been recommended as part of a NEPAD-endorsed strategy for saving Africa's soils and is proposed for sub-Saharan Africa as a component of the Global Digital Soil Map of the World project.

External partnerships include the Earth Institute and CIESIN at Columbia University on land health surveillance in Africa; national soil survey institutes in Africa on field survey of land health; UN agencies (UNEP, FAO, UNDP) and the World Bank on joint project implementation, the International Soil Reference Information Centre (ISRIC) on global soil information services, and other CGIAR centres, such as TSBF-CIAT on integrated soil fertility management, and ICRISAT and the International Center for Agricultural Research in the Dry Areas (ICARDA) on dryland degradation assessment.

World Agroforestry Centre's role in ensuring outcomes and impacts is through (i) joint application of approaches and methods in large projects with national partners, (ii) capacity building of national programmes through MSc and PhD training, training courses, and hands-on training, (iii) dissemination of guidelines and training materials, and (iv) scientific and technical backstopping through advisory services to national programmes.

The primary geographic focus is as for GRP4.1 but more specifically within the agro-ecological

zones below the project will primarily target agro-ecosystems, primarily cultivated land and rangeland.

1. Sub-Saharan Africa

RAEZ 1 Warm arid and semi-arid tropics (AEZ 1): West Africa: Mali, Mauritania, Niger, Senegal, and parts of Burkina Faso. East Africa: Parts of Ethiopia, Kenya, Tanzania and Uganda. Southern Africa: Parts of Madagascar, Malawi, Mozambique, and Zambia.

RAEZ 2 Warm subhumid tropics (AEZ 2): Southern Africa: Parts of Malawi, Mozambique and Zambia.

RAEZ 3 Warm humid tropics (AEZ 3): Parts of Kenya and Ethiopia.

RAEZ 4 Cool tropics (AEZ 4): Rwanda, and parts of Ethiopia, Kenya, Madagascar and Tanzania.

2. Asia and the Pacific

RAEZ 8 Warm arid and semi-arid tropics (AEZ 1): Parts of India.

RAEZ 9 Warm subhumid tropics (AEZ 2): Parts of India.

3. Latin America and the Caribbean

RAEZ 17 Warm humid tropics (AEZ 3): Brazil.

International Public Goods

The IPGs envisaged to be produced by GRP4 include: land health surveillance approaches, methods, standards, tools and protocols; and capacity building in land health surveillance methods. Examples include new scientific concepts for evidence-based assessment of risk factors associated with land degradation, methods for low cost, rapid soil analysis using infrared spectroscopy, new statistical methods for digital mapping of land degradation and soil health that link ground observations to remote sensing information. Elements of this work were recognized as an example of both achieved and emerging IPGs by the 2006 EPMR, in particular the development of infrared spectroscopy for rapid screening of soil health.

Other IPGs include land health risk assessments at multiple scales; spatial targeting and evaluation of Agroforestry interventions in relation to major land degradation problems; and co-development of an Africa Soil Information System. World Agroforestry Centre's comparative advantage is in application of infrared spectroscopy methods to large area land health assessment and systematic ground survey of land health risk factors linked to remote sensing and other geoinformatics, and the application of this data to spatial targeting and evaluation of Agroforestry programmes. The land health surveillance framework is being used in a UNEP capacity-building project to guide strategies for land restoration in five West African dryland countries and in a World Bank-GEF project in Kenya, led by the Kenya Agricultural Research Institute, which is designed to tackle land degradation problems in the Lake Victoria basin. Soil health surveillance has been recommended as part of a NEPAD-endorsed strategy for saving Africa's soils and is proposed for sub-Saharan Africa as a component of the Global Digital Soil Map of the World project.

Elaboration of Partner's Roles

External partnerships include ARIs such as the Earth Institute and CIESIN at Columbia University and BioForsk in Norway on methods development in remote sensing, cyber infrastructure and biometrics; and national soil survey institutes and universities in Africa for capacity building in land health surveillance methods. The project is also working closely with UNEP, UNDP, the World Bank, and NEPAD on integrating research and assessment methods into major land management programmes, such as TerrAfrica. Institutions helping to test and further develop soil-testing methods using infrared spectroscopy include Egerton, Jomo Kenyatta and Nairobi universities in Kenya, and with IIAM in Mozambique, and IER in Mali. The same national research organizations and ministries of agriculture also help with land health surveillance (GRP.4.2). The private sector works with the project on

new technological developments, such as low cost infrared spectrometers for soil analysis in developing countries. For example Bruker Optics (Germany) is providing technical support to World Agroforestry Centre's network of near-infrared spectroscopy laboratories in Africa and the development of high throughput mid-infrared soil analysis.

Other external partnerships include the Earth Institute and CIESIN at Columbia University on land health surveillance in Africa; national soil survey institutes in Africa on field survey of land health; UN agencies (UNEP, FAO, UNDP) and the World Bank on joint project implementation, ISRIC on global soil information services, and other CGIAR centres, such as TSBF-CIAT on integrated soil fertility management, and ICRISAT and ICARDA on dryland degradation assessment.

Global Research Project

5: Agroforestry systems for climate change adaptation and mitigation

Project Overview and Rationale

Project Goal

To improve the resilience of farming systems and livelihood strategies of smallholder farmers to current climate variability as well as long-term climate change, through the increased use of trees for intensification, diversification and buffering of farming systems.

Project Objectives

1. Vulnerability assessment—to assess the social, economic and environmental factors that interact to predispose rural households to climate related shocks.
2. Impact of climate change on Agroforestry systems—to understand the potential impacts of the different dimensions of climate change (water availability, temperature, rainfall intensity, inter-annual variability) at a number of scales: on Agroforestry tree species, on Agroforestry farming systems and on agricultural landscapes.
3. Adaptation to climate change—to determine how tree-based systems can be used to buffer smallholder farmers against climate variability and climate related shocks. Adaptive capacity depends not only on the ability to respond biophysically but also on the economic circumstances and institutional infrastructure.
4. Synergies in Agroforestry systems between climate change adaptation and mitigation—to assess the carbon sequestration potential of promising adaptation technologies with the view of capturing carbon finance opportunities to scale up adoption of these systems to reduce vulnerability of smallholder farmers.

Rationale

Developing countries are going to bear the brunt of climate change and suffer most from its negative impacts. Mitigation efforts will only provide a partial softening of the effects of climate change. Local climates and terrestrial ecosystems will change, threatening biota and human livelihoods. Yet, even as climate changes, food and fibre production, environmental services and rural livelihoods must improve, and not just be maintained.

Climate change is interacting with a number of factors (e.g. macroeconomic policy, population growth) to limit development aspirations and compromise sustainable rural development. In many poor rural landscapes, where access to inputs like fertilizer is limited, farming communities have met the food demands of growing populations through extensification of agriculture rather than through intensification. Cultivating marginal lands is risky at the best of times. Climate change is increasing inter-annual rainfall variability and the frequency of extreme events, leading to accelerated rates of degradation of soil and water resources upon which farming communities depend for their livelihoods.

Agricultural systems most vulnerable to climate change are those already affected by unsustainable management, and land and resource degradation. Trees play an important role in reducing vulnerability, increasing resilience of farming systems and buffering households against climate related risks. There are two hypotheses at the centre of this Project:

- Trees are deep rooted and have large reserves, and are less susceptible than annual crops to inter-annual variability or short-lived extreme events like droughts or floods. Thus, trees offer diversification options that can reduce production risks for smallholder farmers.
- Trees are a perennial resource that can be exploited to provide increased income during difficult periods, thereby reducing

income risks associated with climate related shocks for smallholder farming families.

The challenge for this global project is to evaluate these two hypotheses in different farming systems, different cultural contexts, and in different landscapes. In conjunction with developing knowledge about the potential for trees to help facilitate adaptation, a number of supporting research questions will come to the fore to generate the knowledge necessary to help development agencies create an enabling environment for broader implementation of Agroforestry to facilitate climate change adaptation.

GRP5 has two research outputs:

- GRP5.1: Vulnerability and adaptation of Agroforestry systems to climate variability and change assessed and improved.
- GRP5.2: Carbon sequestration advanced through Agroforestry to enhance livelihoods while mitigating climate change.

Alignment with CGIAR System Priorities (Project Level)

GRP5 matches most closely with CGIAR system priorities and 4A (integrated land, water and forest management at landscape level), 4D (sustainable agro-ecological intensification in low- and high-potential environments), and 5A (science and technology policies and institutions). It also contributes to 3D (sustainable income generation from forests and trees), 5C (rural institutions and their governance) and 5D (improving research and development options to reduce rural poverty and vulnerability). Finally, it is also consistent with new research, development support and capacity building.

Outputs Description

Changes from previous MTP

This project merges the former GP7.2 (methods built for climate change impacts on

biogeochemical processes and water relations) and GP7.4 (climate change adaptation options available for small farmers) in the previous MTP. It also merges elements of GP7.1 (tools developed for carbon sequestration project managers) and GP7.3 (policy communications produced on avoided deforestation, afforestation and reforestation) in the previous MTP.

Description

GRP5.1: Vulnerability and adaptation of Agroforestry systems to climate variability and change assessed and improved

Research activities under GRP5.1 include: vulnerability assessment of rural households, assessment of impacts of climate change on Agroforestry systems, and adaptation to climate change. We will assess the social, economic and environmental factors that interact to predispose rural households to climate related shocks. In addition, we will seek to understand the potential impacts of the different dimensions of climate change (water availability, temperature, rainfall intensity, inter-annual variability) at a number of scales: on Agroforestry tree species, on Agroforestry farming systems and on agricultural landscapes. We will determine how tree-based systems can be used to buffer smallholder farmers against climate variability and climate related shocks. Adaptive capacity depends not only on the ability to respond biophysically but also on the economic circumstances and institutional infrastructure.

As yet, the potential for Agroforestry to help solve the problem of climate change is under-appreciated. Agroforestry options may provide a means for diversifying production systems and increasing the resilience of smallholder farming systems. The most worrisome component of climate change from the point of view of smallholder farmers is increased inter-annual variability in rainfall and temperature. Tree-based systems have some obvious advantages for maintaining production during wetter and drier years. First, their deep root systems are

able to explore a larger soil volume for water and nutrients, which will help during droughts. Second, increased soil porosity, reduced runoff and increased soil cover lead to increased water infiltration and retention in the soil profile, which can reduce moisture stress during low rainfall years. Third, tree-based systems have higher evapotranspiration rates than row crops or pastures and can thus maintain aerated soil conditions by pumping excess water out of the soil profile more rapidly than other production systems. Finally, tree-based production systems often produce crops of higher value than row crops. Thus, diversifying the production system to include a significant tree component may buffer against income risks associated with climatic variability.

GRP5.1 addresses the following goals:

System Priority 4A:

Specific Goal 4: It will analyse impacts of climate change to water resources in watersheds.

System Priority 4D:

Specific Goal 1: It will help develop analytical methods and tools for the management of upland farms in response to changing climate. It will likewise facilitate understanding of the relationship between land use and climate change.

Specific Goal 2: It will help identify climate constraints to the sustainability and improvement of farm productivity.

System Priority 5A

Specific Goal 5: GRP5.1 will assist national research partners by enhancing their capacity to conceptualize and implement research in climate change adaptation.

Systems Priority 5D

Specific Goal: It will develop strategies to reduce vulnerability of farmer's livelihoods to climate change.

Contributing partners include: UNFCCC Secretariat; FAO; UNEP; Worldwide Fund

for Nature (WWF); World Vision; CARE; Development Agencies in Southeast Asia (Department of Environment and Natural Resources, Philippines; Bureau of Soils and Water Management, Philippines; Ministry of Natural Resources and Environment (MoNRE) Vietnam); NGOs in Southeast Asia (Landcare Foundation of the Philippines; Centre for Environment Research, Education and Development (CERED), Vietnam); Universities in Southeast Asia; (University of the Philippines, Institute Perptanian Bogor, National University Lao PDR); CIFOR and Southeast Asian (SEARCA).

GRP5.2: Carbon sequestration advanced through Agroforestry to enhance livelihoods while mitigating climate change

GRP5.2 will explore the synergies in Agroforestry systems between climate change adaptation and mitigation. We will assess the carbon sequestration potential of promising adaptation technologies with the view of capturing carbon finance opportunities to scale up adoption of these systems to reduce vulnerability of smallholder farmers. For example, we will explore ways to compensate small-scale farmers for payments of carbon sequestration services under the emerging carbon market.

The advent of carbon markets over the past decade creates new and significant opportunities for scaling up Agroforestry practices for climate change adaptation and sustainable land management. Projections that the carbon market may exceed \$1 trillion by 2025 (current ODA = \$85 billion) suggest that significant funds could potentially be available to finance sustainable rural development and adaptation to climate change. For the moment, the focus of this international discussion is on tree-based solutions because of the obvious carbon sequestration potential of these systems. Unfortunately, as the carbon markets have developed over the past several years, projects focused on rural communities, poverty reduction, and climate change adaptation through improved land management have not materialized. While there was a lot of optimism

at the beginning of these markets, there are a number of reasons for the lack of contribution to sustainable development in rural areas. World Agroforestry Centre considers these carbon markets to be one of the primary impact pathways for this research. Given this, World Agroforestry Centre will invest considerable effort in overcoming the main obstacles to the mobilization of carbon finance to scale up Agroforestry practices that facilitate adaptation to climate change.

System Priority 4A

Specific Goal 1: GRP5.2 will develop tools for trade-off analyses of alternative land uses that lead to deforestation in the context of the Reduced Emissions from Deforestation in Developing countries (REDD) discussion at the UNFCCC. It will also seek to understand the relationships between land use change and climate change with specific focus on changes carbon stocks.

Specific Goal 2: It will explore ways to compensate small-scale farmers for payments of carbon sequestration services.

System Priorities 4D

Specific goal 1: It will help develop analytical methods and tools for the management of upland farms to enhance carbon sequestration. It will likewise facilitate understanding of the relationship between land use and climate change.

Specific Goal 2: It will develop valuation techniques and means of compensating small farmers for carbon sequestration and conservation in the context of an emerging carbon market.

Specific Goal 5: It will develop tools for trade-off analysis of alternative land uses that lead to deforestation in the context of the REDD discussion at the UNFCCC.

System Priority 3D

Specific Goal: It will study how local people can benefit from carbon benefits provided by trees and forests.

Contributing partners include: UNFCCC Secretariat; FAO; UNEP; WWF; World Vision; CARE; development agencies in Southeast Asia (Department of Environment and Natural Resources, Philippines; Bureau of Soils and Water Management, Philippines; MoNRE, Vietnam); NGOs in Southeast Asia (Landcare Foundation of the Philippines; CERED, Vietnam); Universities in Southeast Asia (University of the Philippines, Institute Peranakan Bogor, National University Lao PDR) and CIFOR.

Alignment with CGIAR priorities (output level)

GRP5.1 aligns with CGIAR System Priority:

4A: Integrated land, water and forest management at landscape level

4D: Sustainable agro-ecological intensification in low- and high-potential environments

5A: Science and technology policies and institutions

5D: Improving research and development options to reduce rural poverty and vulnerability

GRP5.2 aligns with CGIAR System Priority:

4A: Integrated land, water and forest management at landscape level

4D: Sustainable agro-ecological intensification in low- and high-potential environments

3D: Sustainable income generation from forests and trees

Countries of planned research (output level)

Bangladesh, Indonesia, Kampuchea, Laos, Philippines, Samoa, Vietnam, Sri Lanka, Thailand, Brazil, India.

Impact Pathways by Output

GRP5.1

Improved and sustained agro-ecosystem productivity in the face of climate change, as well as enhanced income generation from smallholder carbon sequestration projects are targeted impacts of this global project. These impacts will be achieved through the following outcomes:

- Stakeholders using knowledge to enhance climate change adaptive capacity of smallholder farmers in developing countries.
- Knowledge utilized on the role of Agroforestry and sound natural resource management for enhancing ability of smallholder farmers to adapt to current and future climate change.
- Mainstreaming of Agroforestry knowledge in climate change adaptation and mitigation initiatives in agriculture, environment and forestry.

Climate change adaptation has increasingly gained recognition as a major factor in agricultural development throughout the world. The recent 4th Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) emphasizes the potential risks and vulnerabilities in developing countries, where smallholder farmers are subjected to droughts, delayed onset of rainy seasons, and other perturbations to traditional climatic patterns. There is increasing recognition of the potential role of Agroforestry for addressing such vulnerabilities and development partners as well as international policy makers are calling for major investment by the global community.

Target ecoregions

1. Sub-Saharan Africa

RAEZ 1 Warm arid and semi-arid tropics (AEZ 1):

East Africa: Kenya and Tanzania.

Southern Africa: Malawi.

RAEZ 2 Warm subhumid tropics (AEZ 2):

East Africa: Tanzania.

Southern Africa: Malawi.

2. Asia and the Pacific

RAEZ 8 Warm arid and semi-arid tropics (AEZ 1): Parts of India.

RAEZ 10 Warm humid tropics (AEZ 3):

Bangladesh, Indonesia, Kampuchea, Laos, Philippines, Samoa, Vietnam, and parts of Sri Lanka and Thailand.

3. Latin America and the Caribbean

RAEZ 17 Warm humid tropics (AEZ 3): Brazil.

Beneficiaries and end users

The key clients and major users of the outputs generated in this project are:

- Funding agencies (World Bank, FAO, Department for International Development (DFID), Asian Development Bank, ACIAR, Ford Foundation)
- Development organizations (notably extension systems and international NGOs such as World Vision, CARE)
- Conservation organizations (WWF, Conservation International, The Nature Conservancy)
- National policy makers and programmes
- Research organizations involved in Agroforestry and researchers involved in evaluation
- Global multilateral environmental agreements, specifically the UNFCCC (for mitigation options), UN Convention on Combating Desertification (UNCCD; for adaptation in the drylands)

The end beneficiaries of the information will be smallholder farming communities throughout the developing world, benefiting from the uptake and implementation of the project's outputs by the clients noted above.

GRP5.2

The advent of carbon markets over the past decade creates new and significant opportunities for scaling up Agroforestry practices for climate change adaptation and sustainable land management. The global carbon market doubled in 2007 to US\$ 64 billion compared to the previous year (current ODA = US\$85

billion). Projections that the carbon market may exceed US\$1 trillion by 2025 suggest that significant funds could potentially be available to finance sustainable rural development and adaptation to climate change. For the moment, the focus of this international discussion is on tree-based solutions because of the obvious carbon sequestration potential of these systems. Unfortunately, as the carbon markets have developed over the past several years, projects focused on rural communities, poverty reduction, and climate change adaptation through improved land management have not materialized. While there was a lot of optimism at the beginning of these markets, there are a number of reasons for the lack of contribution to sustainable development in rural areas.

World Agroforestry Centre considers these carbon markets to be one of the primary impact pathways for this research. With significant investment in carbon offsets, it is only logical that a significant portion of this investment facilitates adaptation among those who will be most severely affected by climate change, but who have done the least to create the problem—the rural poor. Given this, World Agroforestry Centre will invest considerable effort in overcoming the main obstacles to the mobilization of carbon finance to scale up Agroforestry practices that facilitate adaptation to climate change. These obstacles include:

- Measurement and monitoring of the carbon benefits of improved practices in agricultural landscapes.
- Institutional links between small-scale farmers and global carbon markets.
- Investor confidence.
- Project developer knowledge.

World Agroforestry Centre will develop a toolbox for project managers. This toolbox will synthesize a wide variety of research products into user-friendly tools for carbon sequestration projects. The tools will address measurement of three carbon pools in Agroforestry projects (above-ground biomass, below-ground

biomass and soil carbon), creation of enabling institutional environments for these projects, sustainable seed supply, biodiversity analysis, social and economic diagnosis and monitoring, etc.

Target ecoregions

1. Sub-Saharan Africa

RAEZ 1 Warm arid and semi-arid tropics (AEZ 1):

East Africa: Kenya and Tanzania.

Southern Africa: Malawi.

RAEZ 2 Warm subhumid tropics (AEZ 2):

East Africa: Tanzania.

Southern Africa: Malawi.

2. Asia and the Pacific

RAEZ 8 Warm arid and semi-arid tropics (AEZ 1): Parts of India.

RAEZ 10 Warm humid tropics (AEZ 3): Bangladesh, Indonesia, Kampuchea, Laos, Philippines, Vietnam, and parts of Sri Lanka and Thailand.

3. Latin America and the Caribbean

RAEZ 17 Warm humid tropics (AEZ 3): Brazil.

Beneficiaries and end users

The key clients and major users of the outputs generated in this project are:

- Funding agencies (World Bank, FAO, DFID, Asian Development Bank, ACIAR, Ford Foundation)
- Development organizations (notably extension systems and international NGOs such as World Vision, CARE)
- Conservation organizations (WWF, Conservation International, The Nature Conservancy)
- National policy makers and programmes
- Research organizations involved in Agroforestry and researchers involved in evaluation
- Global multilateral environmental agreements, specifically the UNFCCC (for mitigation options), UNCCD (for adaptation in the drylands)

The end beneficiaries of the information will be smallholder farming communities throughout the developing world, benefiting from the uptake and implementation of the project's outputs by the clients noted above.

International Public Goods

This GRP will generate a range of IPGs including principles, methodologies, and tools that will have widespread relevance for addressing global climate change problems facing smallholder farmers:

- Knowledge of Agroforestry-based strategies and options for adaptation in various agro-ecological zones (e.g. arid/semi-arid regions of Africa; typhoon-prone areas in the Philippines; high rainfall areas in Indonesia) can be mainstreamed into policies at various levels.
- Knowledge of options for mainstreaming climate change adaptation in Agroforestry and NRM projects in developing countries will help leverage investments in smallholder practices.
- Comprehensive estimates of adaptation costs and benefits, as well as improved understanding of trade-offs in terms of impacts to other sectors and the environment, will be invaluable for designing policy options at multiple levels.

As yet, the potential for Agroforestry to help solve the problem of climate change is under-appreciated. The most worrisome component of climate change from the point of view of smallholder farmers is increased inter-annual variability in rainfall and temperature. Tree-based systems have some obvious advantages for maintaining production during wetter and drier years. First, their deep root systems are able to explore a larger soil volume for water and nutrients, which will help during droughts. Second, increased soil porosity, reduced runoff and increased soil cover lead to increased water infiltration and retention in the soil profile,

which can reduce moisture stress during low rainfall years. Third, tree-based systems have higher evapotranspiration rates than row crops or pastures and can thus maintain aerated soil conditions by pumping excess water out of the soil profile more rapidly than other production systems. Finally, tree-based production systems often produce crops of higher value than row crops. Thus, diversifying the production system to include a significant tree component may buffer against income risks associated with climatic variability.

Agroforestry has a particular role to play in mitigation of atmospheric accumulation of greenhouse gases (GHGs). Of all the land uses analysed in the Land-Use, Land-Use Change and Forestry report of the IPCC, Agroforestry offered the highest potential for carbon sequestration in non-Annex I countries.

Through this project World Agroforestry Centre is well positioned to generate the knowledge to substantiate the above assertions in agricultural landscapes and provide this information to development agencies and policy makers.

- Methods and tools for carbon sequestration projects that are practical for smallholder production systems throughout the developing world.

Elaboration of Partner's Roles

This global research project will build on strong engagement by World Agroforestry Centre in the UNFCCC, and links with major development agencies and NGOs that will demand and can act upon the information generated in the project. Because of the range of methodological innovations to be employed, major investments in strengthening capacity of partners and target beneficiaries are envisaged.

Name of Partner	Collaborative activities	Geographical scope
United Nations Framework Convention on Climate Change Secretariat (UNFCCC)	Attending the various meetings to participate in international policy formulation.	Global
Food and Agriculture Organization of the United Nations (FAO) and United Nations Environment Programme (UNEP)	Taking the science that World Agroforestry Centre develops and mainstreaming these knowledge innovations and best practices for decision making at multiple level.	Global
Worldwide Fund for Nature (WWF), World Vision and CARE	Developing a major initiative on linking carbon finance with poverty reduction in developing countries with these partners by building into their development projects which increasingly tap into Agroforestry options.	Africa
Development agencies in Southeast Asia (Department of Environment and Natural Resources, Philippines; Bureau of Soils and Water Management, Philippines; Ministry of Natural Resources and Environment (MoNRE) Vietnam)	Participate in multi-stakeholder meetings and consultations. Climate change policy formulation.	Southeast Asia
NGOs in Southeast Asia (Landcare Foundation of the Philippines; Centre for Environment Research, Education and Development (CERED), Vietnam)	Participate in climate change adaptation research. Serve as co-study leader.	Southeast Asia
Universities in Southeast Asia (University of the Philippines, Institute Pertanian Bogor, National University Lao PDR)	Serve as co-study leader in climate change project.	Southeast Asia
Center for International Forestry Research (CIFOR)	Collaborate on research on climate change adaptation in watersheds.	Global
Southeast Asian (SEARCA)	Collaborate on policy research on climate change adaptation.	Southeast Asia

Global Research Project 6: Developing policies and incentives for multi-functional landscapes with trees that provide environmental services

Project Overview and Rationale

Project Goal

Policies and incentives are enacted that are more effective in maintaining the multifunctionality of landscapes with trees.

Project Objectives

Undertake action research, synthesis, stakeholder engagement and targeted dissemination to improve understanding of:

1. The roles of trees in securing watershed services, carbon storage and biodiversity maintenance in landscape mosaics.
2. The opportunities for reducing negative incentives, and increasing positive incentives, for pro-poor Agroforestry solutions.
3. The relations and trade-offs between local and more global drivers of land-use change.

Rationale

One of the most significant challenges that humans face is trying to maintain or increase the supply of ecosystem services—water, soil health and biodiversity—especially under changing climates that will continue to support both human needs and the functioning of natural ecosystems. The management of these multifunctional landscapes requires research tools and management mechanisms that strike the balance between (a) ‘goods’ and ‘services’, (b) short, medium and long-term objectives, and (c) ‘efficiency’ and ‘equity’ in the pursuit of sustainable development.

From the perspective of trees—the oldest, largest, and most provisioning living organisms—there

are increasing conflicts and dilemmas between tree plantations, natural forests and trees on farms. Tree systems that generate the highest returns to land often generate lower levels of services, while old-growth natural forests usually generate high levels of environmental services but relatively little income. In this context, Agroforestry can emerge as an intermediate land use with potential to generate good economic returns and acceptable levels of critical environmental services.

The incentives and disincentives that farmers face when deciding to establish and maintain Agroforestry systems are defined by policies emanating from the agricultural, forestry and environmental sectors. For example, the national and local policies put in place to protect forests and environmental services often have the consequence of reducing incentives for Agroforestry. Multilateral environmental agreements establish objectives, obligations and opportunities for national policies and strategies, but rarely harness the potential of Agroforestry to advance environmental objectives.

The role of the different configurations of trees in the provision of environmental services needs to be realistically assessed so that appropriate incentives, property rights arrangements and regulatory approaches can be negotiated and updated through learning. Past World Agroforestry Centre research shows that institutions and arrangements for management of multifunctional landscapes should be assessed in terms of their efficiency (realistic, conditional and voluntary), fairness (pro-poor, pro-women and pro-untitled landholders) and sustainability. Past World Agroforestry Centre research also shows that there is potential for using new property rights arrangements and flexible policy instruments, often implemented through decentralized forms of government, to strengthen farmers’ incentives to invest in Agroforestry. Mechanisms and contracts that provide conditional rewards for environmental services have potential to provide farmers with

incentives to adopt Agroforestry systems and other land uses associated with environmental stewardship or restoration.

Key Research Questions:

The research undertaken in GRP6 will examine:

1. How do landscape-scale watershed and biodiversity services depend on the attributes of Agroforestry systems across climatic, biogeographical, ecological and socio economic contexts?
2. How realistic are expectations that regulation of and incentives for enhancing tree-based watershed and biodiversity services can enhance these environmental services from the perspective of external stakeholders?
3. What are the trade-offs between efficiency, fairness and poverty reduction associated with alternative prototype mechanisms for environmental service rewards involving small farmers?
4. How can cross-sectoral policies and community based forest policy limit or enhance the potential for environmental service rewards, as well as tools, methods and approaches that enhance the sustainability of financial flows and institutional change in environmental service reward mechanisms?
5. What are the drivers of forest transitions and Agroforestry transformations, and where can environmental services-based incentives play a role in these various contexts?

GRP6 has the following research outputs:

- GRP6.1: Roles of trees in watershed services and biodiversity in landscape mosaics and their trade-offs with direct benefits (subsistence and marketed goods) better understood.
- GRP6.2: Pro-poor policies and incentives negotiated for enhancing tree-based environmental services.
- GRP6.3: Links between the drivers of land use change at global—national—local scales and the opportunities

to negotiate and influence Agroforestry transformations better understood.

Alignment to CGIAR Priorities

GRP6 matches closely with System priority 4A (integrated land water and forest management at landscape level), but also contributes to three other System Priorities 4D (agricultural intensification in low/high potential areas), 3D (sustainable income from forests and trees), and 5B (Making international and domestic markets work for the poor).

Outputs Description

Changes from previous MTP Outputs

The strategic planning process identified strong synergies between the former GP5 (landscape level interactions of Agroforestry) and GP8 (policies and incentives for Agroforestry). The new GRP6 incorporates key output targets from those two former GPs. The integrating theme is multi-functional landscapes with trees. Output GRP6.1 concentrates on understanding the impacts of land use and Agroforestry on selected ecosystem services within particular landscapes; Output GRP6.2 concentrates on policies and incentives designed to foster the positive roles of trees and conservation agriculture in those multifunctional landscapes, while the new GRP6.3 will consider the overall dynamic context in which policies are implemented. Our new work on GRP6.3 is founded on the concept of Agroforestry transitions: we appreciate that farmers' motivations to establish and maintain Agroforestry systems are defined by the greater context of land use and forest cover dynamics. The long-term impacts and sustainability of policies and incentives for Agroforestry will depend upon this context.

Description (Output Level)

GRP6.1: Role of trees in watershed services and biodiversity in landscape mosaics and their trade-offs with direct benefits (subsistence and marketed goods) better understood

Trees use water while storing carbon; tree crops replace natural forest while reducing poverty. Market-oriented monocultures compete with risk-averting polycultures, trading off income and risk. Plantations displace smallholders, trading off local rights and income opportunities, while national reforestation programmes use public resources, promising an increase in environmental services that may not happen. Trees in all these examples are closely linked to 'trade-offs' and 'conflict', exaggerated expectations and disappointment. Integrated natural resource management requires site-specific understanding of trade-offs and synergies between and among the goods and services that trees in agro-ecosystems can provide. It is thus more complex when compared to simpler, readily scalable green-revolution technologies. Replicable, cost-effective approaches are needed in the hands of local professionals with interdisciplinary skills to help stakeholders sort out positive and negative effects of trees in multi-use landscapes ('Agroforestry') on livelihoods, water and (agro-) biodiversity, associated rights and rewards, and, ultimately, on the Millennium Development Goals (reducing poverty, promoting equitable forms of globalization and building peace). Research from different parts of the tropical world has shown that multifunctional Agroforestry systems such as shade coffee or cocoa and jungle rubber are viable alternative land-use practices. It has been demonstrated that such alternative land-use can deliver livelihood benefits while maintaining and enhancing ecosystem function, including its scope for resilience. As a result, such systems are becoming increasingly valuable in landscape management approaches to biodiversity conservation and watershed management. More recently, they are gaining recognition as potential targets for avoided deforestation strategies in climate change mitigation. Making the most

of Agroforestry and other tree-based systems, however, requires good information about the ecosystem service values of various systems and practices, the inevitable tradeoffs among those services, and incentives that farmers have to invest in Agroforestry systems, protect other tree-based systems and engage in tree product enterprises. This information will help reinforce the potential importance of multifunctional Agroforestry systems in degradation avoidance and maintaining ecosystem services

GRP6.2: Pro-poor policies and incentives negotiated for enhancing tree-based environmental services.

There is untapped potential to harness market forces and negotiations between ecosystem stewards, intermediaries and ecosystem service beneficiaries. Mechanisms and contracts that provide farmers and other ecosystem stewards with conditional rewards for environmental services can enhance the adoption and maintenance of Agroforestry systems and other land uses consistent with good environmental stewardship. Over the 5+ years, the World Agroforestry Centre has established an approach to research on rewards for environmental services that has generated both context-specific impact and understanding, a set of field-tested tools and approaches, and well-recognized contributions to the international literature. This work will continue in the 2009–2011 period, with more emphasis on Africa, extension of the tools and approaches to more sites, and more emphasis on the role of the public and private sectors.

GRP6.3: Links between the drivers of land use change at global–national–local scales and the opportunities to negotiate and influence Agroforestry transformations better understood

GRP6.3 considers Agroforestry and particular policy interventions within a long-term and wide geographic context. Over long time periods, land use systems tend to respond to changes in population pressure, emerging

market opportunities, and changes in the public policy context. There has been considerable study of so-called forestry transitions: the tendency for increasing population pressure to cause reducing, stable and ultimately increasing, forest cover. There has been less study of the role of Agroforestry in those transitions. Nonetheless, such an understanding is important for understanding the potentials for enhanced Agroforestry in the long term. Many policy processes require this information.

Alignment to CGIAR priorities (output level)

GRP6.1 aligns with CGIAR System Priority:

4A: Promoting integrated land, water and forest management at landscape level

4D: Promoting sustainable agro-ecological intensification in low- and high-potential areas

GRP6.2 aligns with CGIAR System Priority:

4A: Promoting integrated land, water and forest management at landscape level

5B: Making international and domestic markets work for the poor

GRP6.3 aligns with CGIAR System Priority:

3D: Promoting sustainable income generation from forests and trees

4A: Promoting integrated land, water and forest management at landscape level

5B: Making international and domestic markets work for the poor

Countries of planned research (output level)

GRP6.1: Brazil, China, Guinea, India, Indonesia, Kenya, Mali, the Philippines, Tanzania, Thailand, Uganda and Vietnam.

GRP6.2: China, Guinea, India, Indonesia, Kenya, Malawi, the Philippines, Tanzania, Uganda and Vietnam.

GRP6.3: Brazil, China, India, Indonesia, Kenya, Vietnam, Uganda, Thailand, Tanzania, the Philippines, Mali and Malawi.

Impact Pathways by Output

GRP 6.1: Replicable cost-effective models and tools that enhance understanding of the service roles of trees in watershed function and biodiversity in landscape mosaics, and their tradeoffs with the direct goods generated by the systems

Follow through consists of active engagement in capacity building through universities, NGOs and local government agencies, to support them in the development of appropriate training methods and materials. The intended outcome is our project goal: "Local resource managers in multi-use landscapes with trees use cost-effective, replicable tools and approaches to appraise the likely impacts of changes in land use on watershed functions, biodiversity and carbon stocks, as well as economic productivity of the landscape".

This outcome is expected to contribute to the overall impact of World Agroforestry Centre's role of improving lives and landscapes, through more knowledge-based negotiations of changes in landscape mosaics and incentive structures.

In the broad context processes of 'negotiation support' in multi use landscapes as developed by World Agroforestry Centre and partners, a number of conditioning factors have to be recognized before the outputs and outcomes can be achieved:

- Explicit recognition of 'multiple perceptions' and 'knowledge systems' of various stakeholders that informs 'trade-off' analysis across the interests involved.
- Biodiversity conservation *within* landscapes with 'domesticated forests' or complex agroforests.
- Upland–lowland negotiations to produce rules and reward mechanisms for watershed functions, that are based on *site-specific evidence* rather than *perceptions* alone.
- Improved local and national level

appreciation of the role of *diversity and identity* of uplands in supporting niche market opportunities and site-specific development pathways rather than being an obstacle to 'standardized' development.

GRP6.2: Pilot studies, syntheses, tools and policy options delivered for facilitating mechanisms that recognize and reward smallholders for providing local, national and global environmental services through appropriate Agroforestry systems

Intended users include researchers, project developers, policy shapers (including civil society groups) and policy makers. Past experience has shown that World Agroforestry Centre's research on rewards for environmental services is attracting interest from a broad spectrum of research organizations, NGOs, UN agencies, donor agencies and businesses. This interest includes South–North transfer of evidence and experience. Research outputs that are intended to influence multilateral and regional agreements are targeted at key stakeholders who negotiate and influence particular processes.

The project's outputs will generate distinct outcomes over time: (1) in the near term, the project will enhance the effectiveness of the diverse organizations that are interested in rights, compensation and rewards for environmental services; (2) in the intermediate term, it will support new and more effective programmes—at the local, national and international levels—that recognize, compensate and reward farmers for environmental services; and (3) in the longer term, farmers involved in environmental service mechanisms will plant and maintain significantly more trees and implement other land conserving practices.

The end users (ultimate beneficiaries) are farmers and communities who will benefit from environmental service mechanisms, more coherent approaches to environmental stewardship and poverty reduction, while 'mining' of collectively-owned natural

resources will be reduced through effective implementation of environmental stewardship.

The expected impacts are enhanced ecosystem services and human welfare in critical ecosystems around the developing world.

GRP6.3: Analyses, syntheses and targeted policy communications clarify the links between the drivers of land use change at the global, national and local scales and the opportunities to negotiate and influence Agroforestry transformations.

Intended users include development planners in government and NGOs, policy shapers (including civil society groups) and policy makers concerned with the long-term and large-scale rural development.

The expected outcomes are that the project's outputs will generate and inform overall investment and development planning processes, including public investments and strategies in Agroforestry research and development.

The end users (ultimate beneficiaries) are farmers and communities who will benefit from environmental service mechanisms, more coherent approaches to environmental stewardship and poverty reduction, while 'mining' of collectively-owned natural resources will be reduced through effective implementation of environmental stewardship.

The expected impacts are enhanced ecosystem services and human welfare in critical ecosystems around the developing world.

International Public Goods

World Agroforestry Centre is becoming a recognized global leader in applied and strategic mechanisms providing rewards for ecosystem services. The Centre's approach stresses action research in contrasting sites, the possibility of a range of payment types, development of parsimonious assessment tools to clarify the real links between land use and ecosystem services,

the importance of the negotiation process itself, cross-site learning and synthesis, and engagement with policy makers and the private sector. From 2003 to 2005, this work focused on Asia and Latin America.

In Asia, our work has been organized around the RUPES project (Rewarding the Poor for Environmental Services) and in Latin America around the ProAmbiente programme in the Amazon basin. The period 2006–2007 has been a time for generating major syntheses and presenting the work in international fora. It was during this period that the World Agroforestry Centre led a pan-tropical assessment with collaborators from around the world.

From 2008 to 2010 this research will be deepened in Asia and the Brazilian Amazon, and extended to Africa and other parts of the Amazon basin. The operational project in Africa is entitled PRESA—Pro-poor Rewards for Environmental Services in Africa. These projects are designed to be engaged with reward mechanisms in action research sites as well as in local and national policy dialogue. They are also linked to global expertise and debates and aim at producing IPGs in the following methods, tested hypotheses and policy-relevant syntheses.

Elaboration of Partners Roles

World Agroforestry Centre advances GRP6 through specific research partnerships as well as consortia of organizations engaged in policy experiments in different ways and at different scales. Among others, we have research partnerships with CIFOR through the joint CIFOR–World Agroforestry Centre biodiversity platform, Conservation International through the Hotspot Alliance, and the Sustainability Science Group at the Kennedy School of Environment at Harvard University, and Hohenheim University.

The RUPES project involves a range of international organizations, national policy groups, national and local research and development organizations working across Asia, including Indonesia, the Philippines, China, Vietnam, India, Nepal and Thailand. A similar network will be established in Africa in collaboration with Care International, the Katoomba Group for East and Southern Africa, AHL, national government organizations, local NGOs, and private sector collaborators. In the Amazon Basin, World Agroforestry Centre conducts similar research on rewards for ecosystem services through the Amazon Initiative Consortium and a number of Brazilian institutions, including the ProAmbiente Programme. We also have a growing collaboration with the Kennedy School of Environment at Harvard University.

At the international scale, we collaborate in the production of international publications with Forest Trends, IUCN, UNEP, IDRC, ACTS (African Centre for Technology Studies) (Kenya), CGRR (Ecuador), and ISEC (India).

ASB Partnership for the Tropical Forest Margins

Project Overview and Rationale

Project Goal

Raise productivity and income of rural households living in the tropical forest margins without increasing deforestation or undermining essential environmental services.

Project Objective

Evaluate options for addressing climate change in agriculture—forest landscapes in the humid tropics for improving incomes of rural households, strengthening community engagement and maintaining essential environmental services and proactively provide information on those options to influence relevant policy and programme design processes, particularly national and international policies on REDD.

The main policy focus for ASB, at least through the end of 2009, is Reduced Emissions from Deforestation in Developing countries (REDD). In the long term, the project would seek to strengthen the incentives for land users in the tropical forest margins to maintain trees and forests for their standing carbon value.

ASB—the partnership, the integration of disciplines and perspective, the methods, the databases, the approach, the brand—is uniquely positioned to bring science-based evidence into the fresh new debates on avoided deforestation. This realization brought into new focus, energy and commitment to the work of ASB partnership in 2007.

Rationale

The last 2 years have seen a remarkable resurgence in global concern about tropical deforestation. Besides contributing to the loss of biodiversity and other environmental services, it is becoming increasingly apparent that tropical deforestation is a major source of GHG emissions responsible for climate change. There

is a new surge of interest across the globe regarding the possibilities of mitigating GHG emissions through avoided deforestation. The UNFCCC is the main focal point for global-level discussion. At the 13th meeting of the Conference of Parties to the UNFCCC in December 2007, nearly every head of state and high profile speaker spoke of the need to explicitly address REDD within the convention. The Conference of Parties passed a resolution that “Encourages all parties, in a position to do so, to support capacity-building, provide technical assistance, facilitate transfer of technology to improve, inter alia, data collection, estimation of emissions from deforestation and forest degradation, monitoring and addressing the institutional needs of developing countries for estimating emissions from deforestation and degradation ...” (Paragraph 2 of Decision -/CMP.3). This global-level initiative is being mirrored by national-level initiatives in both developed countries and developing countries. The Government of Norway is investing hundreds of millions of dollars in forest carbon management, while both the United States and Europe are considering the potential for allowing forest carbon credits to be traded in cap-and-trade emission management schemes. There is also strong interest in developing countries. For example, so far some 37 developing countries have requested the World Bank Forest Carbon Partnership Fund to assist them with plans for ‘getting ready for REDD’. An array of foundations, UN organizations and international conservation organizations have expressed support for REDD and other Avoided Deforestation initiatives.

The ASB Partnership for the Tropical Forest Margins is uniquely well placed to bridge the ‘top-down’ perspective of global GHG mitigation with a ‘bottom-up’ perspective of the causes and consequences of land-use change at the tropical forest margins. Building upon the previous decade of ASB research, ASB partners across the tropics have initiated a major study of the dynamics of land use, carbon gain and loss, and returns to land in ASB benchmark sites across the tropical forest margins. The interim

results, released at COP-13 in Bali, provide new insight into the role of economics as a driver of land-use change and the relatively low returns per unit of carbon loss that are generated by carbon-emitting land use changes. In 2007, ASB partners in Indonesia became heavily involved in national-level discussions about deforestation and the best way for the country to reduce emissions from deforestation and forest degradation. ASB research and insights garnered considerable attention from the international media and research communities.

In December 2007, the Global Steering Group (GSG) that governs ASB reconsidered the relevance of its goal and objective statements in light of the attention being given to the carbon storage value of tropical forests. The GSG noted the distinct comparative advantage of the ASB partnership in working on land use, livelihoods and environmental services at the tropical forest margins. The GSG decided that the goal is still very relevant and should not be changed. The GSG adopted a more tightly-defined medium-term objective that recognizes the importance of the climate change policy context and the need for both high-quality research and effective communication of research results.

For 2009–2011, ASB will have two major outputs which stem from this medium-term objective:

ASB1. Options for addressing climate change in agriculture—forest landscapes in the humid tropics for improving incomes of rural households, strengthening community engagement and maintaining essential environmental services evaluated.

- Opportunity cost analyses
- Estimates of the GHG (CO₂ and non-CO₂) associated with alternative land uses and land-use change
- Methods for measurement of the carbon stocks and fluxes associated with a wide range of forestry, Agroforestry and crop agriculture systems

- Assessment of technical, policy and reward mechanisms for reducing incentives for land users to deforest and increasing incentives for land users to invest in forest

ASB2. Information on those options to influence relevant policy and programme design processes, particularly national and international policies on REDD proactively provided.

- Tested guidelines for REDD demonstration projects published
- Policy-relevant information targeted to key decision makers at the national, regional and national levels
- Information on the possibilities for avoided deforestation with sustainable benefits disseminated to the global public

Changes from previous MTP

Two main events in December, 2007 Conference of Parties (COP-13) and 16th ASB-Global Steering Group (GSG) meeting in Bali, influenced a change in the MTP outputs of ASB. The GSG adopted a sharper medium-term objective that recognizes the importance of research and communication of research results.

At the UNFCCC COP-13 in Bali in December 2007, parties agreed on a two-year process to determine the modalities for a post 2012 climate agreement including for REDD. The Bali Decision on REDD (Decision -/CP.13) in its preamble recognizes the growing consensus that terrestrial carbon sequestration is important for simultaneously contributing to carbon sequestration, enhancing development and protecting biodiversity. The preamble also points to the need for capacity building in developing countries to enable this happen as follows:

“ Encourages all parties, in a position to do so, to support capacity-building, provide technical assistance, facilitate transfer of technology to improve, inter alia, data collection, estimation of emissions from deforestation and forest degradation, monitoring and addressing the

institutional needs of developing countries for estimating emissions from deforestation and degradation ..." (Paragraph 2 of Decision -/CP.13)

Since ASB's presentation during the UNFCCC COP-13 in Bali, the findings of the ASB study have attracted a good deal of attention from key players in the global debate on REDD. A summary of the media attention is presented at <http://www.asb.cgiar.org/>.

The results are directly relevant to ongoing debates on REDD within the UNFCCC. ASB results are equally relevant to regional and national policies and programmes for REDD.

ASB's work is now positioned to contribute to the shaping of the post-2012 climate change regime, and the rules by which common but differentiated responsibility and accountability for climate change will be linked to global commitments to support development. ASB aims to make a significant contribution to the evaluation of mechanisms that translate international-level agreements into instruments that will help change the behaviour of the people at the 'coal-face,' while making the most of the potential to improve their livelihoods and the local resource base on which they depend.

Alignment to CGIAR priorities (project level)

The ASB partnership received the CGIAR Science Award for 'Outstanding Partnership' in 2005. It also received a very positive EPMR, published in June 2006. Please see report at www.sciencecouncil.cgiar.org/publications/pdf/ASB_REPORT_website.pdf

The ASB external programme and management review concluded that the ASB partnership continues to be highly relevant to the CGIAR's goals and is pursuing work that fits well with CGIAR System Priorities. ASB is most closely aligned with Priority 4A (integrated land, water and forest management at landscape level). ASB also contributes to system priorities 5B (making

international and domestic markets work for the poor) and 3D (promoting sustainable income generation from forests and trees).

Outputs Description

Changes from previous MTP

In the 2008–2010 MTP, ASB organized its work around three outputs, relating to research, synthesis and dissemination, and networking and capacity building. Following the revised medium-term objective shown above, ASB has revised its set of outputs to two: one around targeted research (done in a geographically distributed and highly collaborative mode) and the second around communication of research results to high priority audiences. The ASB partners perceive that during the 2009–2011 period, it will be particularly important to focus on research topics that are defined by the avoided deforestation policy context and to ensure that past and current ASB results are effectively synthesized and communicated into that policy context. Networking and capacity building are seen as tools to achieve those outputs, rather than important outputs on their own.

Description (output level)

ASB1: Options for addressing climate change in agriculture — forest landscapes in the humid tropics for improving incomes of rural households, strengthening community engagement and maintaining essential environmental services evaluated

ASB research examines policies and programmes for avoided deforestation and REDD through the perspective of sustainable rural development in the tropical forest margins.

Current discussions of REDD and avoided deforestation at the international policy level are focusing on the potential for different types of financial transfers from industrialized countries to developing countries that maintain and restore forest cover. Research

by ASB partners does support the proposition that avoided deforestation will require real changes in the financial rewards provided to those who make land use decisions in the tropical forest margins. International transfers may contribute to those changes in incentives but will not be sufficient without accompanying changes in policies and development strategies. Other land use and land management options need to be incorporated in effective and credible REDD or avoided deforestation programmes. The ASB research agenda focuses on livelihoods, land use, landscape management and environmental services in the multiple-use landscapes found at the tropical forest margins. Issues of particular interest to the ASB partnership include the carbon implications of different agricultural development pathways, the effects of high-carbon land uses on other environmental services, multi-stakeholder approaches to management for multi-use landscapes, reduction in disincentives for on-farm tree management, and the potential for enhancing security of property rights to land, trees and carbon.

ASB2: Information on options for addressing climate change in agriculture—forest landscapes in the humid tropics is synthesized and proactively disseminated to influence relevant policy and programme design processes, particularly national and international policies on avoided deforestation with sustainable benefits

Compared to other sectors and issues, policies relevant to climate change quite rapidly. International climate negotiations and national policy formulation processes create time-bound windows of opportunity for researchers to enhance the base of evidence on which policies are founded. 2008–2009 is an important window of opportunity in the UNFCCC process for harnessing the GHG mitigation potential of REDD. There now appears to be a similar window of opportunity to influence the shape of new climate legislation in the United States.

New windows of opportunity are likely to open over the next months, in both developing and developed countries. The ASB partnership has developed an important corpus of research results over the last 10 years, research results that need to be refined, synthesized and effectively communicated before they can really become part of the evidence base for policy formulation. ASB experience in 2007 indicates that this requires a combination of excellent science and a strategic approach to communication. ASB will also develop feedback loops from communications to research. That is, research priorities in this fast moving area need to take account of likely future windows for policy influence.

Alignment with CGIAR priorities (output level)

ASB1 aligns with CGIAR System Priority:

- 3D: Sustainable income generation from forests and trees
- 4A: Integrated land, water and forest management at landscape level
- 5B: Making international and domestic markets work for the poor

ASB2 aligns with CGIAR System Priority:

- 3D: Sustainable income generation from forests and trees
- 4A: Integrated land, water and forest management at landscape level
- 5B: Making international and domestic markets work for the poor

Countries of planned research

Brazil, Peru, Cameroon, Indonesia, Philippines and Thailand.

Impact Pathways by Output

ASB1: Options for addressing climate change in agriculture—forest landscapes in the humid tropics for improving incomes of rural households, strengthening community engagement and maintaining essential environmental services evaluated

Intended users include the growing research, development and policy communities who are concerned with rural development, deforestation and environmental services in the tropical forest margins. ASB will achieve this goal through pan-tropical research that establishes the potential cost-effectiveness of REDD; research on the trade-offs between carbon storage, biodiversity and hydrologic services; development and testing of appropriate tools for baseline assessment and monitoring of REDD programmes; and engagement in REDD demonstration activities.

Researchers working at the tropical forest margins conduct research that is more effective and better linked to important policy processes. Workable organizational structures and processes identified and implemented that link integrative science with policy and practice in the search for better approaches to poverty reduction, NRM, and rainforest conservation. Policy makers at the national and international scales adopt policies, negotiation processes and institutions that reduce incentives for deforestation.

Appreciable slowing in the rate of tropical deforestation in countries that consider ASB outputs in the design of policies, incentive systems and negotiation approaches. Smallholder farmers living in the tropical forest margins have more secure land rights and incentives to undertake investments and land uses consistent with essential environmental services.

Current estimates by ASB indicate that more than 1.8 billion people live within the humid tropical and subtropical forest biome; of these 1.2 billion people live in rural areas. Most are poor households directly dependent on forest resources and agriculture for their livelihoods. Other poor households suffer indirectly from waste of these resources and environmental degradation. Because ASB's target ecosystems supply global public goods (globally-significant habitats and carbon storage), beneficiaries also include the earth's entire population.

ASB works at the margins of the world's remaining tropical rainforests, in landscape mosaics comprising both forests and farms. These rainforests are an invaluable natural heritage. They are also home to over one billion rural people, the vast majority of whom are poor and depend directly on forest resources and agriculture for their livelihoods. The present ASB network includes six countries in the humid tropics. It is envisaged that the network will expand considerably in the next years.

ASB2: Information on options for addressing climate change in agriculture—forest landscapes in the humid tropics is synthesized and proactively disseminated to influence relevant policy and programme design processes, particularly national and international policies on avoided deforestation with sustainable benefits

Intended users include the growing research, development and policy communities who are concerned with rural development, deforestation and environmental services in the tropical forest margins. Most importantly, results from that research will be disseminated to three audiences: climate change negotiators and their forestry advisors in both developed and developing countries; government and non-government organizations involved in the design of REDD demonstration activities; and the global general public who need to be aware of the importance of deforestation as a source of GHGs, and the need for appropriate incentives and benefit sharing to make avoided deforestation a reality.

Researchers working at the tropical forest margins conduct research that is more effective and better linked to important policy processes. Workable organizational structures and processes identified and implemented that link integrative science with policy and practice in the search for better approaches to poverty reduction, natural resource management, and rainforest conservation. Policy makers at the national and international scales adopt policies,

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International Public Goods

The ASB Systemwide Programme has been designed to produce IPGs. The GSG identifies issues and policy problems to be addressed, with priority given to problems common across the tropical forest margins. Thematic working groups develop and agree upon the methods to be applied and syntheses to be generated. Site-specific work, using common protocols, is done through teams of national and international

scientists. Synthesis teams draw together results by site, theme and across sites and themes. Engagement with international policy processes clarifies the potential for linking site-specific research to global issues.

Elaboration of Partner's Roles

ASB is a multi-level, global consortium of more than 80 institutions governed by a GSG and coordinated by a Global Coordination Office. The GSG is made up of 11 representative organizations—including 5 international agricultural research centres (CIAT, CIFOR, World Agroforestry, IITA and IFPRI) and 6 national research systems (Brazil, Peru, Cameroon, Thailand, Indonesia and the Philippines). The GSG determines priorities and approves annual work programmes, budgets and the allocation of funding. The programme is hosted by World Agroforestry Centre, which provides institutional support, including financial controls.

In addition, the ASB consortium includes about 70 other organizations that collaborate on particular aspects of the research agenda (e.g. particular funded projects, particular countries and particular themes) or in the provision of financial resources. As of 2007, this included:

- 7 local and national NGOs in developing countries
- 8 other national agencies in developing countries
- 13 universities in developing countries
- 14 advanced research institutions and international organizations.

In 2007, the Global Coordination Office focused considerable attention on participation by the 11 core members, including the CGIAR centres. During 2008–2009, more attention will be given to the revitalization of the broader partnership, including new research partnerships with advanced research institutions, new links to international organizations, and new funding sources.

Name of Partner	What they will do	Output	Geographical scope
CIFOR, IITA, IFPRI, CIAT, TSBF/CIAT	Collaborate in studies of research on the trade-offs between carbon storage, biodiversity and hydrologic services; development and testing of appropriate tools for baseline assessment and monitoring of REDD programmes; and engagement in REDD demonstration activities in ASB sites in Latin America, Asia and Africa.	ASB1 ASB2	Humid tropics of Africa, Asia and Latin America
NARS organizations in Thailand, the Philippines, Indonesia, Cameroon, Brazil and Peru	Collaborate in studies of research on the trade-offs between carbon storage, biodiversity and hydrologic services; development and testing of appropriate tools for baseline assessment and monitoring of REDD programmes; and engagement in REDD demonstration activities in Latin America, Asia and Africa. Indonesia organizations will co-lead events on REDD.	ASB1 ASB2	Humid tropics of Africa, Asia and Latin America
Advanced research institutes in Europe and North America	Complement ASB studies of research on the trade-offs between carbon storage, biodiversity and hydrologic services; development and testing of appropriate tools for baseline assessment and monitoring of REDD programmes; and engagement in REDD demonstration activities for greater impact on the UNFCCC processes. Contribute advanced research methods and skills.	ASB1 ASB2	Humid tropics of Africa, Asia and Latin America

Chapter 3

PROJECT LOG FRAMES

Global Research Project 1: Domestication, utilization and conservation of superior Agroforestry germplasm

GIRP1.1: Improved tree germplasm and associated information developed through appropriate methods			
Output Targets	Intended Users	Outcomes	Impacts
2009 <i>Materials:</i> (1) Germplasm of high-value tree species domesticated in partnership with smallholder farmers in two regions.	The primary beneficiaries are national tree seed agencies, farmers, tree nursery operators, national forestry and agroforestry research institutes, NGOs, universities and extension agents. The end users of the tree knowledge and tree germplasm produced by the project include: CBOs, development agencies, extension agents, farmers, inter-governmental bodies involved in germplasm transfers, international research institutions, local policy makers, national policy makers, national research institutions, NGOs, producer associations, regional bodies involved in germplasm regulation, and tree seed marketers.	Greater availability of updated and well-documented information on key Agroforestry species.	Better tree germplasm is available and used by smallholders to plant and manage trees that meet their demands.
2010 <i>Other knowledge:</i> (1) Analyses of species × management site interactions produced to better understand and enhance cultivation practices and targeting of tree species.		Increased species diversity in seed multiplication programmes and nurseries. Effect tree domestication approaches used by national partners.	

GRP1.2: Sustainable tree seed and seedling supply systems developed while promoting conservation using appropriate partnerships				
Output Targets	Intended Users	Outcomes	Impacts	
<p><u>2009</u> <i>Materials:</i> (1) Germplasm of native tree species for diversification of reforestation/re-greening efforts in SE Asia.</p> <p><u>2010</u> <i>Other knowledge:</i> (1) Sustainable models of seed- and seedling-input supply systems for Agroforestry tree species developed, including fruit trees.</p> <p><u>2011</u> <i>Policy/Strategy:</i> (1) Regulatory procedures collated and disseminated to facilitate efficient germplasm dissemination and exchange.</p>	<p>The primary beneficiaries are national tree seed agencies, farmers, tree nursery operators, national forestry and agroforestry research institutes, NGOs, universities and extension agents. The end users of the tree knowledge and tree germplasm produced by the project include: CBOs, development agencies, extension agents, farmers, inter-governmental bodies involved in germplasm transfers, international research institutions, local policy makers, national policy makers, national research institutions, NGOs, producer associations, regional bodies involved in germplasm regulation, and tree seed marketers.</p>	<p>Models for decentralized private Agroforestry germplasm supply systems adopted.</p> <p>Genetic diversity of key Agroforestry species conserved.</p> <p>Policy reforms to facilitate international exchange of tree germplasm.</p>	<p>Better tree germplasm is available and used by smallholders to plant and manage trees that meet their demands.</p>	

Global Research Project 2: Improving on-farm productivity of trees and Agroforestry systems

GRP2.1: Enhanced better understood costs, benefits and risks of agroforestry technologies and systems under varying conditions			
Output Targets	Intended Users	Outcomes	Impacts
<p>2009</p> <p><i>Practice:</i> (1) Tree integration and management techniques on farm developed in high altitudes agrarian landscapes in Central Africa; (2) Integration options produced for indigenous tree species and fruit trees in mixed-based farming systems in acid upland soils in SE Asia.</p> <p><i>Other knowledge:</i> (1) At least 4 case studies published on options for integrating 'trees farmers want' into Agroforestry technologies that adjust to biophysical and socioeconomic context.</p> <p><i>Capacity:</i> (1) Capacity-building materials based on management for timber tree-based systems for upland farmers in Asia produced.</p>	<p>Researchers in NARS, ARIIs and universities.</p> <p>Ministries of agriculture and natural resources and other development institutions.</p> <p>Extension systems, NGOs, CBOs, private sector, land users and smallholder farmers.</p> <p>Policy makers and funding agencies.</p>	<p>Development implementers use improved tools and knowledge to make more informed choices on integrating Agroforestry into farming systems.</p> <p>Improved Agroforestry principles and options for smallholder farmers will be adapted and applied by research and development organizations.</p>	<p>Agroforestry management and tree-based intensification options on farm are understood and used by smallholders to match livelihood strategies and available resources.</p>
<p>2010</p> <p><i>Materials:</i> (1) Production of asexually propagated superior clones of rubber for cereal based systems in SE Asia.</p> <p><i>Practice:</i> (1) Tree diversification efforts produced for shade trees in coffee systems in East Africa.</p> <p><i>Other knowledge:</i> (1) Experiences and lessons learnt on the adoption, promotion and impact of Agroforestry and natural resource management technologies in Africa and Southeast Asia synthesized and published.</p>			
<p>2011</p> <p><i>Policy/Strategy:</i> (1) Guidelines for policy makers on strategies to promote conservation agriculture practices on small farms in West and Central Africa.</p> <p><i>Practice:</i> (1) On-farm assessment of <i>Gliricidia sepium</i> system and its biomass transfer and fertilizers on paprika in Southern Africa; Bamboo as 'filter species' in Southeast Asia.</p> <p><i>Capacity:</i> (1) Management guidelines of Agroforestry systems developed for at least two native fruit trees in West and Central Africa; and for teak based in southeast Asia; (2) Guidelines on improved shade management in coffee systems in East Africa.</p>			

GRP2.2: Principles, methods and practices developed for improved tree and Agroforestry management.			
Output Targets	Intended Users	Outcomes	Impacts
<p>2009 <i>Policy/Strategy:</i> (1) Principles, models and frameworks for pest risk assessment and management developed in southern Africa; (2) Principles and framework for implementing community dialogues and negotiation mechanism for policy change to facilitate widespread adoption of Agroforestry technologies established. <i>Other knowledge:</i> (1) At least two case studies of the adoption potential of specific Agroforestry technologies and at least one on the impacts of Agroforestry systems on water conservation and productivity assessed in water limited ecologies.</p>	<p>Researchers in NARS, ARIs, universities, UN institutions. Ministries of agriculture and natural resources and other development institutions. Policy makers, extension systems, NGOs, CBOs, private sector, land users and smallholder farmers.</p>	<p>Development organizations and policy makers use principles and techniques (for water, pest and disease, etc.) for more effective Agroforestry development.</p>	<p>Agroforestry management and tree-based intensification options on farm are understood and used by smallholders to match livelihood strategies and available resources.</p>
<p>2010 <i>Policy/Strategy:</i> (1) Integrated management strategies developed to conserve the genetic resources for both crops and trees on farm developed in Southeast Asia; (2) Impacts of Agroforestry systems on water conservation and productivity assessed in south Asia. <i>Practice:</i> (1) Guidelines on genetic resource management of native trees on-farm for the Sahel developed. <i>Other knowledge:</i> (1) Journal articles on tree diversity of native trees on farms and their impacts on rural livelihoods; and tree diversity and abundance of native trees and their genetic conservation on small farms developed for south Asia, Southeast Asia and the Sahel; (2) Extent of poverty and food insecurity problems and implications for targeting Agroforestry research and development assessed and published in one southern Africa country.</p>	<p>Managers of education and training institutions.</p>		
<p>2011 <i>Practice:</i> (1) Management options for home gardens Agroforestry systems in South Asia developed. <i>Capacity:</i> (1) Options on conservation agriculture techniques on water conservation and productivity developed for national research institutions in at least three western and central African countries.</p>			

Global Research Project 3: Improving tree product marketing for smallholders

GRP3.1 Approaches for improving smallholder access to tree product value chains developed			
Output Targets	Intended Users	Outcomes	Impacts
<p><u>2009</u> <i>Policy/Strategy:</i> (1) Framework developed for assessing whether and how organic certification initiatives can benefit poor smallholders developed. <i>Other knowledge:</i> (1) A comparative analysis of alternative certification systems available for coffee farmers in East Africa. <i>Capacity:</i> (1) Guide to facilitating collective action to improve farmers' access to markets, with emphasis on women, the poor and vulnerable.</p> <p><u>2010</u> <i>Practice:</i> (1) Approaches tested for achieving premium value transfer between ecologically certified producers and end users without complex chain of custody mechanisms; (2) Approaches assessed for enhancing the role of women in collective action for marketing Agroforestry products; (3) Strategies for public private partnerships to promote tree product marketing developed.</p> <p><u>2011</u> <i>Practice:</i> (1) <i>Ziziphus</i> fruit quality analyses published and quality standards defined.</p>	Farmer organizations, donors, NGOs, governments, certification bodies, coffee farmer organizations, policy makers, NGOs, women's organizations, public organizations and private companies.	<p>Certification interventions that are more accessible and beneficial to smallholder farmers.</p> <p>More effective farmer organizations that negotiate higher prices for farmers, lower transaction costs and facilitate flows of market information.</p> <p>Women's organizations and organizations supporting women use improved approaches for engaging women collective action for marketing.</p> <p>Private companies and public organizations make more informed decisions and enhance collaborative actions.</p>	Smallholders have access to and benefit from existing and emerging markets for Agroforestry products.

GRP3.2 Improved marketing strategies to enhance performance of tree product value chains and smallholder livelihoods			
Output Targets	Intended Users	Outcomes	Impacts
<u>2009</u> <i>Policy/Strategy:</i> (1) Decision support tool on whether to help farmers capture a bigger portion of value chain or to more effectively link them to traders for marketing their produce. <i>Other knowledge:</i> (1) Assessment published of the role of vouchers in strengthening private seed and seedling markets.	Farmer organizations, organizations supporting such organizations including governments and NGOs, donors. Policy makers, researchers and policy analysts for local resource managers.	Farmer organizations, private companies and entities supporting them making sounder investment and marketing decisions on Agroforestry products.	Smallholders have access to and benefit from existing and emerging markets for Agroforestry products.
<u>2010</u> <i>Policy/Strategy:</i> (1) Marketing strategies developed for selected natural products. <i>Practice:</i> (1) Model for assessing ex ante feasibility and profitability of leaf meal industry tested at one site in East, Southern, and West Africa.	Private companies, farmer organizations. Private companies, NGOs, policy makers, farmer organizations.	Greater understanding and use of vouchers in seed and seedlings supply systems. Improved policies to support development of Agroforestry related enterprises.	
<u>2011</u> <i>Other knowledge:</i> (1) Synthesis of farmer enterprise impacts on community structures.			

Global Research Project 4: Reducing land health risks and targeting Agroforestry interventions to enhance land productivity

GRP4.1: Effective land health surveillance methods developed				
Output Targets	Intended Users	Outcomes	Impacts	
<u>2009</u> <i>Practice:</i> (1) Land health risk assessment conceptual framework. <i>Other knowledge:</i> (1) Global soil infrared spectral library interpretation system. <i>Capacity:</i> (1) Technical backstopping service and capacity building materials on land health surveillance methods in Eastern, Southern and West Africa.	Government policy makers, UN agencies, and funding agencies. Scientists at national, international research institutes. Development organizations.	Governments, UN agencies and funding agencies aware of benefits of land health surveillance science and technology. Researchers use improved methods for land degradation and soil quality assessment.	Adoption of Agroforestry systems that avoid/revert land degradation problems and risks.	
<u>2010</u> <i>Practice:</i> (1) Guidelines on statistical analysis of land health surveillance and soil spectral data. <i>Capacity:</i> (1) Technical backstopping and capacity building on land health surveillance methods for NEPAD platform and national programmes in Africa and Asia.		Development implementers use improved tools and knowledge to make informed choices on improving land management and targeting Agroforestry interventions to enhance land productivity.		
<u>2011</u> <i>Practice:</i> (1) Guidelines on assessing land health risks and evaluating land management interventions to reduce and reverse risks. <i>Other knowledge:</i> (1) Improved statistical methods for analysis of land health surveillance data. <i>Capacity:</i> (1) Technical backstopping and capacity building on land health surveillance methods for NEPAD platform and national programmes in Africa and Asia.				

GRP4.2: Land health risks assessed and Agroforestry interventions to reduce and reverse land degradation well targeted			
Output Targets	Intended Users	Outcomes	Impacts
<p>2009</p> <p><i>Practice:</i> (1) Africa Soil Information System (ASIS) established.</p> <p><i>Policy/Strategy:</i> (1) Policy-relevant information produced on land degradation risks in West Africa Sahel.</p> <p><i>Other knowledge:</i> (1) Data on land health condition and risks for sentinel sites in sub-Saharan Africa published.</p>	<p>Government policy makers, UN organizations and international donors.</p> <p>Scientists at national, international research institutes.</p> <p>Development organizations.</p> <p>Extension systems.</p>	<p>Evidence-based management principles and spatially-explicit strategies are used to steer land management research and development programmes.</p> <p>National scientists better target Agroforestry based land management options to specific land degradation problems and risks.</p> <p>Improved Agroforestry based land and soil management options applied and adapted by development organizations.</p>	<p>Adoption of Agroforestry systems that avoid/revert land degradation problems and risks.</p>
<p>2010</p> <p><i>Policy/Strategy:</i> (1) Policy-relevant information on land health risks and Agroforestry opportunities in Africa.</p> <p><i>Other knowledge:</i> (1) Evidence-based analysis of land degradation risks and Agroforestry opportunities to reduce and reverse risks in Africa.</p>			
<p>2011</p> <p><i>Policy/Strategy:</i> (1) Policy-relevant information on land health risks and Agroforestry opportunities in Asia.</p> <p><i>Other knowledge:</i> (1) Evidence-based analysis of land health risks in sub-Saharan Africa and Asia and targeted Agroforestry opportunities to reduce and reverse risks.</p>			

Global Research Project 5: Agroforestry Systems for Climate Change Adaptation and Mitigation

GRP5.1 Vulnerability and adaptation of Agroforestry systems to climate variability and change assessed and improved			
Output Targets	Intended Users	Outcomes	Impacts
2009 Practice: (1) Candidate practices and strategies for climate change adaptation developed.	Agroforestry farmers in developing countries. National development agencies. Researchers. Managers of international adaptation funds (e.g. World Bank).	Local knowledge on climate risk adaptation available and used as basis for climate change adaptation practices and strategies.	Smallholder agroforesters are better able to adapt to current and future climate, and can benefit from participation in efforts to mitigate climate change ('carbon markets').
2010 Policy/Strategy: (1) Strategies for mainstreaming climate change in agriculture and NRM.		Policy options identified and implemented for mainstreaming climate change adaptation in agriculture and NRM development.	
2011 Practice: (1) Best practices for climate change adaptation for small farmers produced.			
GRP5.2 Carbon sequestration through Agroforestry to enhance livelihoods while mitigating climate change			
Output Targets	Intended Users	Outcomes	Impacts
2009 Practice: (1) Carbon measurement and monitoring system produced; (2) Climate change impacts on biogeochemical processes identified. Other knowledge: (1) Trade-offs between alternative land uses that destroys forests in the context of REDD.	Project developers. National agencies in charge of climate change projects. NGOs and POs. Researchers in developing countries. Climate policy makers, particularly members of G77/China negotiating block. NGOs engaged in the UNFCCC process. Small farmers who live at the edges of forests.	Smallholder communities have greater opportunities to participate in carbon sequestration projects.	Smallholder agroforesters are better able to adapt to current and future climate, and can benefit from participation in efforts to mitigate climate change ('carbon markets').
2010 Practice: (1) Full tool box for carbon sequestration project design produced. Capacity: (1) Guidelines for REDD that will benefit small farmers and local communities.		Better understanding and use of how climate change will impact nitrogen cycle in nitrogen limited soils and how water relations will change as a result of climate change.	
2011 Practice: (1) Revised carbon measurement system and project developers tool box.			

Global Research Project 6: Developing policies and incentives for multi-functional landscapes with trees that provide environmental services

GRP6.1: Roles of trees in watershed services and biodiversity in landscape mosaics and their tradeoffs with direct benefits (subsistence and marketed goods)			
Output Targets	Intended Users	Outcomes	Impacts
<p><u>2009</u></p> <p><i>Practice:</i> (1) Use of indicators and tools for appraising the likely impacts of changes in land use on watershed functions, biodiversity and economic productivity in context of spatial planning and rewards for environmental services in several new case studies in SE Asia, resulting in method improvement. <i>Other knowledge:</i> (1) Test results of biodiversity platform hypotheses at working paper level; (2) Tests of new forms of outcome based rewards for environmental services, grounded in local monitoring and resource management, rather than input control.</p> <p><i>Capacity:</i> (1) Capacity building materials for intermediaries, local and national stakeholders on 'avoided deforestation with sustainable benefits' (REDD at landscape scale).</p>	<p>Researchers and policy analysts for local resource managers.</p>	<p>Local resource managers in multi-use landscapes with trees use cost-effective, replicable tools and approaches to appraise the likely impacts of changes in land use on watershed functions, biodiversity and carbon stocks, as well as on economic productivity of the landscape.</p>	<p>Realistic use of trees for transforming lives and landscapes and attaining critical ecosystem services in multifunctional landscapes.</p>
<p><u>2010</u></p> <p><i>Practice:</i> (1) Further use and development of rapid appraisal methods in regions beyond SE Asia.</p> <p><i>Other knowledge:</i> (1) Publications based on comparisons within SE Asia; (2) Synthesis on use of locally adapted indicators for landscape-scale monitoring and learning on biodiversity and watershed functions.</p>			
<p><u>2011</u></p> <p><i>Capacity:</i> (1) Synthesis on model validation experience in form of PhD thesis; test of use of the tools for practical PES approaches.</p> <p><i>Other knowledge:</i> (1) Publications based on cross-regional comparison of experience across PRESA (Africa), RUPES (Asia) and the landscapes of the CIFOR/World Agroforestry Centre biodiversity platform project.</p>			

GRP6.2 Pro-poor policies and incentives negotiated for enhancing tree-based environmental services				
Output Targets	Intended Users	Outcomes	Impacts	
<u>2009</u> <i>Practice:</i> (1) Technology advisory tool developed for guiding the selection of appropriate Agroforestry and conservation agriculture technologies in the East African highlands. <i>Policy/ strategy:</i> (1) Series of publications on the role of RUPES as a boundary organization that links knowledge and practice. <i>Other knowledge:</i> (1) Completed study of the motivations of private sector investors in carbon management. <i>Capacity:</i> (1) Capacity building materials for researchers from across Africa in economic tools and models for assessing the economic and environmental impacts of alternative Agroforestry systems.	Environmental management agencies, NGOs, researchers, local government agencies.	Successful environmental service mechanisms implemented in a range of sites across Africa, Asia and Latin America.	Realistic use of trees for transforming lives and landscapes and attaining critical ecosystem services in multifunctional landscapes.	
<u>2010</u> <i>Practice:</i> (1) Technology advisory tool is used to select and spatially target Agroforestry and conservation agriculture technologies in at least 3 sites in the East and West African highlands. <i>Policy/strategy:</i> (1) Prototype reward mechanisms implemented in at least 3 sites in the East African highlands and 3 sites in Asia. <i>Other knowledge:</i> (1) Completed study of the production and ecological economics of alternative tree production systems. <i>Capacity:</i> (1) Policy makers and policy shapers in at least 4 countries are involved in introductory courses on payments for environmental services.				
<u>2011</u> <i>Policy/Strategy:</i> (1) Policy options to facilitate conditional rewards for environmental services are developed with policy makers in Africa and Asia. <i>Other knowledge:</i> (1) Completed studies of the economic and social impacts of payments for carbon sequestration.				

GRP6.3 Links between the drivers of land use change at global-national-local scales and the opportunities to negotiate and influence agroforestry transformations				
Output Targets	Intended Users	Outcomes	Impacts	
<p><u>2009</u></p> <p><i>Policy/Strategy:</i> (1) The concerns and interests of Agroforestry producer groups are brought into important agriculture and environment policy processes in Southern Africa.</p> <p><i>Other knowledge:</i> (1) Synthesis on the role of Agroforestry in the 'forest transition' or recovery of tree cover after a phase of deforestation, with analysis of the driving forces and policy constraints that need to be removed.</p>	Negotiators for multi-lateral environmental agreements; planners for regional environmental plans (e.g. NEPAD); Environmental Facility; regional organizations; international policy shapers (e.g. World Bank, IUCN).	International and regional conventions, agreements and action plans are modified to better facilitate the contributions of smallholder farmers practicing Agroforestry.	Realistic use of trees for transforming lives and landscapes and attaining critical ecosystem services in multifunctional landscapes.	
<p><u>2010</u></p> <p><i>Policy/Strategy:</i> (1) At least one avoided deforestation pilot study designed and implementation begun.</p> <p><i>Other knowledge:</i> (1) Comparison of different modelling approaches for analysis of the driving forces for land use change in the sub-humid tropics and their consequences for livelihoods and environmental services.</p>				
<p><u>2011</u></p> <p><i>Policy/Strategy:</i> (1) At least one avoided deforestation pilot study designed and implementation begun.</p> <p><i>Other knowledge:</i> (1) Pan-tropical spatial characterization of Agroforestry and its dependence on environmental, socio-economic and policy conditions.</p>				

ASB1. Options for addressing climate change in agriculture – forest landscapes in the humid tropics for improving incomes of rural households, strengthening community engagement and maintaining essential environmental services evaluated.			
Output Targets	Intended Users	Outcomes	Impacts
<u>2009</u> <i>Other knowledge:</i> (1) New methods for baseline assessment and monitoring of landscape-level carbon stocks tested in ASB sites.	National and international researchers. UN agencies, donors, national environment agencies, UNFCCC negotiators.	Researchers working at the tropical forest margins conduct research that is more effective and better linked to important policy processes.	Appreciable slowing in the rate of tropical deforestation in countries that consider ASB outputs in the design of policies, incentive systems and negotiation approaches. Smallholder farmers living in the tropical forest margins have more secure land rights and incentives to undertake investments and land uses consistent with essential environmental services.
<u>2010</u> <i>Other knowledge:</i> (1) A new spatial analysis of the carbon, livelihood and environmental service trade-offs associated with alternative development pathways in multiple ASB sites.			
<u>2011</u> <i>Other knowledge:</i> (1) Dynamic trade-off studies published for an expanded set of sites in the tropical forest margins, including avoided deforestation and REDD pilot studies.			

ASB2. Information on options for addressing climate change in agriculture—forest landscapes in the humid tropics is synthesized and proactively disseminated to influence relevant policy and programme design processes, particularly national and international policies on avoided deforestation with sustainable benefits.			
Output Targets	Intended Users	Outcomes	Impacts
<u>2009</u> <i>Policy/Strategy:</i> (1) Synthesis papers that draw out the implications of ASB research for avoided deforestation with sustainable benefits are published in high profile journals and summarized into targeted outputs for selected policy processes, particularly the UNFCCC COP in Copenhagen.	National and international researchers. UN agencies, donors, national environment agencies, UNFCCC negotiators.	Workable organizational structures and processes identified and implemented that link integrative science with policy and practice in the search for better approaches to poverty reduction, natural resource management, and rainforest conservation. Policy makers at the national and international scales adopt policies, negotiation processes and institutions that reduce incentives for deforestation.	Appreciable slowing in the rate of tropical deforestation in countries that consider ASB outputs in the design of policies, incentive systems and negotiation approaches. Smallholder farmers living in the tropical forest margins have more secure land rights and incentives to undertake investments and land uses consistent with essential environmental services.
<u>2010</u> <i>Policy/Strategy:</i> (1) Analytical papers and policy briefs that consider the implications of 2009 climate agreements and legislation on plans and policies for sustainable development in the tropical forest margins.			
<u>2011</u> <i>Policy/Strategy:</i> (1) Synthesis papers and policy briefs summarizing experience with avoided deforestation and REDD pilot studies for key policy processes.			

Chapter 4

FINANCIAL TABLES

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WorldAgroforestry Table 1: Allocation of Project Costs by Priority Area and Priorities, 2009

in \$millions

	Priority Area 1	Priority Area 2	Priority Area 3		Priority Area 4			Priority Area 5				Non-Priority Area			
Project	1B	2D	3A	3D	4A	4C	4D	5A	5B	5C	5D	Development Activities	New Research Areas	Stand- alone Training	Total
ASB					0.192				0.082						0.274
GRP1	0.327	1.634	2.287		0.653						0.327	0.327	0.653	0.327	6.535
GRP2		0.332		0.664	0.664	0.664	0.664					0.165	0.165		3.318
GRP3			1.162	0.697					1.161	0.464	0.464	0.464	0.232		4.644
GRP4					0.489	0.163	2.122				0.163		0.163	0.163	3.263
GRP5				0.167	0.334	0.167	0.500	0.500	0.500	0.333	0.333	0.167	0.167	0.167	3.335
GRP6				0.752	2.256	0.376		1.504		1.128		0.376	0.751	0.376	7.519
Total	0.327	1.966	3.449	2.280	4.588	1.370	3.286	2.004	1.743	1.925	1.287	1.499	2.131	1.033	28.888

WorldAgroforestry Table 2: Allocation of Project Costs to CGIAR Priorities, 2007–2011

in \$millions

Projects	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
Priorities					
ASB: Alternatives to Slash-and-Burn Systemwide Programme					
4A	0.321	0.183	0.192	0.196	0.200
5B	0.137	0.078	0.082	0.084	0.086
Total Project	0.458	0.261	0.274	0.280	0.286
GRP1					
1B	0.329	0.311	0.327	0.334	0.340
2D	1.648	1.553	1.634	1.668	1.702
3A	2.307	2.172	2.287	2.333	2.383
4A	0.659	0.621	0.653	0.667	0.681
5D	0.329	0.311	0.327	0.334	0.340
Development Activities	0.329	0.311	0.327	0.334	0.340
Stand-alone Training	0.329	0.311	0.327	0.334	0.340
New Research Areas	0.659	0.621	0.653	0.667	0.681
Total Project	6.589	6.211	6.535	6.671	6.807
GRP2					
2D	0.331	0.314	0.332	0.339	0.347
3D	0.663	0.631	0.664	0.677	0.691
4A	0.663	0.631	0.664	0.677	0.691

WorldAgroforestry Table 2: Allocation of Project Costs to CGIAR Priorities, 2007–2011

in \$millions					
Projects	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
Priorities					
4C	0.663	0.631	0.664	0.677	0.691
4D	0.663	0.631	0.664	0.677	0.691
Development Activities	0.166	0.158	0.165	0.170	0.173
New Research Areas	0.166	0.158	0.165	0.170	0.173
Total Project	3.315	3.154	3.318	3.387	3.457
GRP3					
3A	1.179	1.104	1.162	1.186	1.209
3D	0.707	0.662	0.697	0.711	0.726
5B	1.178	1.104	1.161	1.185	1.209
5C	0.471	0.441	0.464	0.474	0.484
5D	0.471	0.441	0.464	0.474	0.484
Development Activities	0.471	0.441	0.464	0.474	0.484
New Research Areas	0.236	0.221	0.232	0.237	0.242
Total Project	4.713	4.414	4.644	4.741	4.838
GRP4					
4A	0.555	0.465	0.489	0.500	0.510
4C	0.185	0.155	0.163	0.167	0.170
4D	2.406	2.017	2.122	2.163	2.209
5D	0.185	0.155	0.163	0.167	0.170
Stand-alone Training	0.185	0.155	0.163	0.167	0.170
New Research Areas	0.185	0.155	0.163	0.167	0.170
Total Project	3.701	3.102	3.263	3.331	3.399
GRP5					
3D	0.152	0.158	0.167	0.170	0.174
4A	0.304	0.317	0.334	0.340	0.347
4C	0.152	0.158	0.167	0.170	0.174
4D	0.455	0.476	0.500	0.511	0.521
5A	0.454	0.476	0.500	0.511	0.521
5B	0.454	0.476	0.500	0.512	0.521
5C	0.304	0.317	0.333	0.340	0.347
5D	0.304	0.317	0.333	0.340	0.347
Development Activities	0.152	0.158	0.167	0.170	0.174
Stand-alone Training	0.152	0.158	0.167	0.170	0.174

WorldAgroforestry Table 2: Allocation of Project Costs to CGIAR Priorities, 2007–2011					
in \$millions					
Projects	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
Priorities					
New Research Areas	0.152	0.158	0.167	0.170	0.174
Total Project	3.035	3.169	3.335	3.404	3.474
GRP6					
3D	0.701	0.715	0.752	0.768	0.783
4A	2.101	2.144	2.256	2.303	2.350
4C	0.350	0.357	0.376	0.384	0.392
5A	1.401	1.429	1.504	1.534	1.566
5C	1.051	1.072	1.128	1.150	1.174
Development Activities	0.350	0.357	0.376	0.384	0.392
Stand-alone Training	0.350	0.357	0.376	0.384	0.392
New Research Areas	0.701	0.715	0.751	0.768	0.783
Total Project	7.005	7.146	7.519	7.675	7.832
Total	28.816	27.457	28.888	29.489	30.093

WorldAgroforestry Table 3: Summary of Project Costs, 2007–2011					
in \$millions					
Project	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
ASB: Alternatives to Slash-and-Burn Systemwide Programme	0.458	0.261	0.274	0.280	0.286
GRP1	6.589	6.211	6.535	6.671	6.807
GRP2	3.315	3.154	3.318	3.387	3.457
GRP3	4.713	4.414	4.644	4.741	4.838
GRP4	3.701	3.102	3.263	3.331	3.399
GRP5	3.035	3.169	3.335	3.404	3.474
GRP6	7.005	7.146	7.519	7.675	7.832
Total	28.816	27.457	28.888	29.489	30.093

WorldAgroforestry Table 4: Summary of Priority Costs, 2007–2011

in \$millions					
Priorities	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
1B	0.329	0.311	0.327	0.334	0.340
2D	1.979	1.867	1.966	2.007	2.049
3A	3.486	3.276	3.449	3.519	3.592
3D	2.223	2.166	2.280	2.326	2.374
4A	4.603	4.361	4.588	4.683	4.779
4C	1.350	1.301	1.370	1.398	1.427
4D	3.524	3.124	3.286	3.351	3.421
5A	1.855	1.905	2.004	2.045	2.087
5B	1.769	1.658	1.743	1.781	1.816
5C	1.826	1.830	1.925	1.964	2.005
5D	1.289	1.224	1.287	1.315	1.341
Development Activities	1.468	1.425	1.499	1.532	1.563
Stand-alone Training	1.016	0.981	1.033	1.055	1.076
New Research Areas	2.099	2.028	2.131	2.179	2.223
Total	28.816	27.457	28.888	29.489	30.093

WorldAgroforestry Table 5: Investments by Undertaking, Activity and Sector, 2007–2011
in \$millions

	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
Increasing Productivity	4.121	3.927	4.131	4.218	4.304
Germplasm Enhancement & Breeding	1.132	1.079	1.135	1.159	1.182
Production Systems Development & Management	2.989	2.848	2.997	3.059	3.122
Cropping systems	0	0	0	0	0.000
Livestock systems	0	0	0	0	0.000
Tree systems	2.989	2.848	2.997	3.059	3.122
Fish systems	0	0	0	0	0.000
Protecting the Environment	5.077	4.837	5.09	5.195	5.302
Saving Biodiversity	3.708	3.533	3.717	3.795	3.872
Improving Policies	7.077	6.743	7.094	7.242	7.390
Strengthening NARS	8.833	8.417	8.856	9.039	9.225
Training and Professional Development	4.848	4.639	4.895	5.004	5.108
Documentation, Publications, Information Dissemination	3.323	3.166	3.331	3.400	3.470
Organization & Management Counselling	0.16	0.152	0.160	0.164	0.167
Networks	0.503	0.461	0.470	0.471	0.481
Total	28.816	27.457	28.888	29.489	30.093

WorldAgroforestry Table 6: Project Investments by Developing Region, 2007–2011 in \$millions						
Project		Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
ASB: Alternatives to Slash- and-Burn Systemwide Programme	Asia	0.183	0.104	0.110	0.111	0.114
	LAC	0.046	0.026	0.027	0.028	0.029
	SSA	0.229	0.130	0.137	0.139	0.143
Total Project		0.458	0.260	0.274	0.278	0.286
GRP1	Asia	2.883	2.150	2.262	2.309	2.356
	LAC	0.071	0.000	0.000	0.000	0.000
	SSA	3.635	4.061	4.273	4.362	4.451
Total Project		6.589	6.211	6.535	6.671	6.807
GRP2	Asia	1.117	0.294	0.309	0.316	0.322
	LAC	0.085	0.000	0.000	0.000	0.000
	SSA	2.112	2.860	3.009	3.071	3.134
Total Project		3.314	3.154	3.318	3.387	3.456
GRP3	Asia	0.215	0.232	0.244	0.249	0.255
	LAC	0.103	0.572	0.602	0.615	0.627
	SSA	4.395	3.610	3.798	3.877	3.956
Total Project		4.713	4.414	4.644	4.741	4.838
GRP4	Asia	0.931	0.140	0.147	0.151	0.154
	LAC	0.052	0.552	0.581	0.593	0.605
	SSA	2.718	2.410	2.535	2.588	2.641
Total Project		3.701	3.102	3.263	3.332	3.400
GRP5	Asia	0.580	1.747	1.838	1.876	1.914
	LAC	0.000	0.000	0.000	0.000	0.000
	SSA	2.455	1.423	1.497	1.528	1.559
Total Project		3.035	3.170	3.335	3.404	3.473
GRP6	Asia	2.884	3.924	4.129	4.215	4.301
	LAC	0.273	0.831	0.874	0.893	0.911
	SSA	3.849	2.391	2.516	2.568	2.621
Total Project		7.006	7.146	7.519	7.676	7.833
Total		28.816	27.457	28.888	29.489	30.093

WorldAgroforestry Table 7: Summary of Investments by Developing Region, 2007–2011

in \$millions					
Region	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
SSA	19.393	16.885	17.765	18.133	18.505
Asia	8.793	8.591	9.039	9.227	9.416
LAC	0.630	1.981	2.084	2.129	2.172
Total	28.816	27.457	28.888	29.489	30.093

WorldAgroforestry Table 8: Expenditure by Object, 2007–2011

in \$millions					
Object of Expenditure	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
Personnel	12.003	12.223	12.860	13.128	13.397
Supplies and services	8.575	8.027	8.446	8.621	8.798
Collaboration/Partnerships	4.206	3.941	4.146	4.232	4.319
Operational Travel	2.991	2.057	2.164	2.209	2.254
Depreciation	1.041	1.209	1.272	1.299	1.325
Total	28.816	27.457	28.888	29.489	30.093

WorldAgroforestry Table 9: Member and Non-Member Unrestricted Grants, 2007–2009

in \$millions NC = National Currency							
Member	Type NC	Actual 2007 (US\$)	Actual 2007 (NC)	Estimated 2008 (US\$)	Estimated 2008 (NC)	Proposal 2009 (US\$)	Proposal 2009 (NC)
Unrestricted Grants							
Member							
Australia	AUD	0.188	0.250	0.220	0.250	0.220	0.250
Belgium	EURO	0.000	0.000	0.444	0.320	0.440	0.320
Canada	CAD	0.782	0.820	0.744	0.818	0.740	0.818
China	USD	0.020	0.020	0.020	0.020	0.020	0.020
Denmark	DKK	0.000	0.000	1.080	5.400	1.080	5.400
Finland	EURO	0.513	0.416	0.467	0.415	0.460	0.415
Germany	EURO	0.355	0.260	0.361	0.260	0.360	0.260
Ireland	EURO	1.412	0.950	1.319	0.950	1.320	0.950
Japan	JPY	0.007	0.772	0.000	0.000	0.000	0.000
Netherlands	EURO	0.617	0.500	0.734	0.500	0.730	0.500
Norway	NOK	0.721	4.100	0.965	5.500	0.960	5.500
Philippines	USD	0.010	0.010	0.005	0.005	0.005	0.005
South Africa	USD	0.000	0.000	0.020	0.020	0.020	0.020
Sweden	SEK	0.506	3.400	0.472	3.400	0.470	3.400
Switzerland	CHF	0.443	0.500	0.403	0.500	0.400	0.500
Thailand	USD	0.010	0.010	0.010	0.010	0.010	0.010
United Kingdom	GBP	1.286	0.630	1.235	0.630	1.230	0.630
United States	USD	0.779	0.779	0.363	0.363	0.360	0.363
World Bank	USD	1.800	1.800	1.800	1.800	1.800	1.800
Subtotal		9.449		10.662		10.625	
Non-member							
Aid to Africa	USD	0.005	0.005	0.002	0.002	0.002	0.002
Subtotal		0.005		0.002		0.002	
Total Unrestricted		9.454		10.664		10.627	

WorldAgroforestry Table 9a: Member and Non-Member Unrestricted and Restricted Grants, 2007–2009

in \$millions			
Member/Non-Member	Actual 2007	Estimated 2008	Proposal 2009
Unrestricted Grants			
Member			
Australia	0.188	0.220	0.220
Belgium	0.000	0.444	0.440
Canada	0.782	0.744	0.740
China	0.020	0.020	0.020
Denmark	0.000	1.080	1.080
Finland	0.513	0.467	0.460
Germany	0.355	0.361	0.360
Ireland	1.412	1.319	1.320
Japan	0.007	0.000	0.000
Netherlands	0.617	0.734	0.730
Norway	0.721	0.965	0.960
Philippines	0.010	0.005	0.005
South Africa	0.000	0.020	0.020
Sweden	0.506	0.472	0.470
Switzerland	0.443	0.403	0.400
Thailand	0.010	0.010	0.010
United Kingdom	1.286	1.235	1.230
United States	0.779	0.363	0.360
World Bank	1.800	1.800	1.800
Subtotal	9.449	10.662	10.625
Non-member			
Aid to Africa	0.005	0.002	0.002
Subtotal	0.005	0.002	0.002
Total Unrestricted	9.454	10.664	10.627

WorldAgroforestry Table 9a: Member and Non-Member Unrestricted and Restricted Grants, 2007–2009

in \$millions			
Member/Non-Member	Actual 2007	Estimated 2008	Proposal 2009
Restricted Grants			
Member			
Australia	0.317	0.115	0.122
Austria	0.131	0.000	0.000
Belgium	0.599	0.000	0.000
Brazil	0.049	0.048	0.051
Canada	0.674	0.256	0.269
CGIAR	0.034	0.000	0.000
European Commission	3.449	1.798	1.892
FAO	0.080	0.252	0.265
Finland	0.161	0.289	0.304
Ford Foundation	0.361	0.192	0.202
Germany	0.221	0.613	0.646
IDB	0.038	0.196	0.205
IDRC	0.636	0.039	0.041
IFAD	1.091	1.305	1.372
India	0.000	0.300	0.316
Ireland	0.927	1.411	1.483
Italy	0.181	0.183	0.193
Japan	0.015	0.189	0.199
Kenya	0.184	0.000	0.000
Netherlands	0.780	0.954	1.006
Norway	0.043	0.087	0.092
Peru	0.036	0.074	0.078
Rockefeller Foundation	0.066	0.000	0.000
Spain	0.150	0.068	0.071
Sweden	1.197	1.085	1.140
Syngenta Foundation	0.009	0.000	0.000
UNDP	0.093	0.055	0.058
UNEP	0.457	0.085	0.089
United Kingdom	0.605	0.129	0.137
United States	2.991	1.916	2.013
World Bank	0.396	0.729	0.689

WorldAgroforestry Table 9a: Member and Non-Member Unrestricted and Restricted Grants, 2007–2009

in \$millions				
Member/Non-Member	Actual 2007	Estimated 2008	Proposal 2009	
Subtotal	15.971	12.368	12.933	
Non-member				
African Wildlife Foundation	0.101	0.093	0.098	
ASARECA	1.031	0.000	0.000	
Bill and Melinda Gates Foundation	0.008	0.000	0.000	
Bioversity International	0.018	0.000	0.000	
CARE	0.043	0.000	0.000	
Centre for Cultural and Technical Interchange	0.034	0.032	0.034	
CIAT	0.050	0.021	0.022	
CIFOR	0.081	0.198	0.208	
CIP	0.027	0.000	0.000	
CIRAD	0.130	0.196	0.207	
Columbia University	0.130	0.053	0.056	
Common Fund for Commodities (CFC)	0.881	0.000	0.000	
Conservation International Foundation	0.117	0.000	0.000	
Cornell University	0.005	0.000	0.000	
CTA	0.032	0.000	0.000	
Forum for Agricultural Research in Africa (FARA)	0.003	0.042	0.044	
Global Environment Facility (GEF)	0.238	0.239	0.251	
Global Mountain Programme (GMP)	0.083	0.072	0.076	
Heifer International	0.000	0.689	0.725	
ICRISAT	0.000	0.016	0.016	
IFPRI	0.243	0.000	0.000	
ILRI	0.012	0.015	0.017	
Institute for Law & Environment Governance (ILEG)	0.009	0.000	0.000	
International Foundation for Science (IFS)	0.006	0.000	0.000	
International Institute for Environment & Development (IIED)	0.003	0.000	0.000	
IRRI	0.060	0.041	0.043	
IUCN	0.145	0.059	0.062	
Katholic University y Leuven (KUL)	0.176	0.177	0.187	
Laguna Lake Development Authority	0.005	0.000	0.000	
McKnight Foundation	0.000	0.029	0.029	
National Science Foundation (NSF)	0.006	0.000	0.000	

WorldAgroforestry Table 9a: Member and Non-Member Unrestricted and Restricted Grants, 2007–2009

in \$millions			
Member/Non-Member	Actual 2007	Estimated 2008	Proposal 2009
Others	0.643	1.873	0.645
Plan International	0.028	0.018	0.019
Unidentified	0.000	0.000	1.773
Unilever	0.074	0.000	0.000
University of Utrecht	0.003	0.000	0.000
World Resources Institute (WRI)	0.013	0.000	0.000
World Wildlife Fund	0.055	0.062	0.066
Subtotal	4.493	3.925	4.578
Total Restricted	20.464	16.293	17.511
Total Grants	29.918	26.957	28.138

Summary and Statement of Activities	Actual 2007	Estimated 2008	Proposal 2009
Total Grants	29.918	26.957	28.138
Centre Income	1.571	0.900	0.950
Revenue	31.489	27.857	29.088
Total Investment	28.816	27.457	28.888
Surplus (Deficit)	2.673	0.400	0.200

WorldAgroforestry Table 10: Allocation of Member Grants and Centre Income to Projects, 2007–2009

in \$millions

Project			Actual 2007	Estimated 2008	Proposal 2009
ASB: Alternatives to Slash-and-Burn Systemwide Programme	Member	Japan	0.002	0.000	0.000
		World Bank	0.263	0.123	0.150
	Non-Member Unrestricted + Centre Income	Others	0.003	0.000	0.000
			0.190	0.138	0.124
		Project Total		0.458	0.261

WorldAgroforestry Table 11: Internationally and Nationally Recruited Staff, 2007–2011

in \$millions

	Actual 2007	Estimated 2008	Proposal 2009	Plan 1 2010	Plan 2 2011
NRS	239	237	238	238	238
IRS	57	49	54	54	54
Total	296	286	292	292	292

WorldAgroforestry Table 12: Currency Structure of Expenditure, 2007–2009

in millions of units and percent

Currency	Actual 2007			Estimated 2008			Proposal 2009		
	Amount	\$ Value	% Share	Amount	\$ Value	% Share	Amount	\$ Value	% Share
IDR	1,2246.800	1.351	5	1,1064.473	1.221	4	1,1640.000	1.280	4
KES	412.560	6.191	21	426.487	6.400	23	392.000	6.500	23
Others	1,3718.000	4.192	15	1,2393.640	3.787	14	1,3040.000	3.603	12
USD	0.000	14.105	49	0.000	13.359	49	0.000	14.905	52
XOF	4322.500	2.977	10	3905.198	2.690	10	4109.000	2.600	9
Total		28.816	100 %		27.457	100 %		28.888	100 %

WorldAgroforestry Table 13: Statement of Financial Position (SFP), 2007–2009
in \$millions

Assets, Liabilities and Net Assets	2007	2008	2009
Current Assets			
Cash and Cash Equivalents	18.851	18.888	18.412
Investments	0.000	0.000	0.000
Accounts Receivable			
- Donor	7.487	6.544	7.12
- Employees	0.074	0.080	0.068
- Other CGIAR Centres	0.576	0.689	0.544
- Others	2.251	1.888	1.629
Inventories	0.091	0.085	0.072
Pre-paid Expenses	0.035	0.040	0.040
Total Current Assets	29.365	28.214	27.885
Non-Current Assets			
Net Property, Plan and Equipment	5.444	5.226	5.034
Investments	0.000	0	0.000
Other Assets	0.000	0	0.000
Total Non-Current Assets	5.444	5.226	5.034
Total Assets	34.809	33.44	32.919
Current Liabilities			
Overdraft/Short Term Borrowings	0.000	0.000	0.000
Accounts Payable			
- Donor	8.943	8.256	8.484
- Employees	0.967	0.646	0.546
- Other CGIAR Centres	0.177	0.168	0.217
- Others	1.304	0.840	0.663
Accruals and Provisions	3.669	3.081	2.296
Total Current Liabilities	15.060	12.991	12.206
Non-Current Liabilities			
Accounts Payable			
- Employees	4.02	4.32	4.384
- Deferred Grant Revenue	0	0.000	0.000
- Others	0	0.000	0.000
Total Non-Current Liabilities	4.020	4.320	4.384
Total Liabilities	19.080	17.311	16.590
Net Assets			
Unrestricted			
- Fixed Assets	9.168	9.168	9.168
- Unrestricted Net Assets Excluding Fixed Assets	6.561	6.961	7.161
Total Unrestricted Net Assets	15.729	16.129	16.329
Restricted	0.000	0.000	0.000
Total Net Assets	15.729	16.129	16.329
Total Liabilities and Net Assets	34.809	33.440	32.919

World Agroforestry Table 14: Statement of Activities (SOA), 2007–2009

		in \$millions					
		Unrestricted	Restricted		Total		
			Temporary	Challenge Programs	2007	2008	2009
Revenue and Gains	Grant Revenue	9.454	20.471	0.046	29.971	26.957	28.138
	Other revenue and gains	1.571	0.000	0.000	1.571	0.900	0.950
	Total revenue and gains	11.025	20.471	0.046	31.542	27.857	29.088
Expenses and Losses	Programme related expenses	6.373	20.420	0.046	26.839	23.238	24.568
	Management and general expenses	4.196	0.051	0.000	4.247	4.219	4.320
	Other losses expenses	0.000	0.000	0.000	0.000	0.000	0.000
	Sub Total expenses and losses	10.569	20.471	0.046	31.086	27.457	28.888
	Indirect cost recovery	-2.270	0.000	0.000	-2.270	0.000	0.000
	Total expenses and losses	8.299	20.471	0.046	28.816	27.457	28.888
	Net Operating Surplus/ (Deficit)	2.726	0.000	0.000	2.726	0.400	0.200
	Extraordinary Items	0.000	0.000	0.000	0.000	0.000	0.000
	NET SURPLUS / (DEFICIT)	2.726	0.000	0.000	2.726	0.400	0.200
Object of Expenditure	Personnel	6.389	5.614	0.000	12.003	12.223	12.860
	Supplies and services	0.256	8.298	0.021	8.575	8.027	8.446
	Collaboration/ Partnerships	0.473	3.733	0.000	4.206	3.941	4.146
	Operational Travel	0.583	2.383	0.025	2.991	2.057	2.164
	Depreciation	0.598	0.443	0.000	1.041	1.209	1.272
Total		8.299	20.471	0.046	28.816	27.457	28.888

Chapter 5

ANNEX

Progress Report on Implementation of External Review Recommendations

Recommendation as listed in EPMP Report	World Agroforestry Centre Response Accepted or not accepted	Implementation		
		Milestones	Progress Achieved	Target Date of Completion
Recommendation 1 <i>World Agroforestry Centre consolidates its strategic research priorities into a long-term workable strategic plan that directs more effort towards a small number of relevant emerging research topics. (page 93)</i>	Accepted	The new strategy received Board approval in April 2008; the Hans Gregerson mini-review of December 2007 endorsed the directions taken in the new strategy. We now await additional comments from the Science Council before publication and distribution of the strategy.	Completed	
Recommendation 2 <i>An analysis be undertaken of the likely impacts of involvement in large development projects, including the Millennium Villages Project, on World Agroforestry Centre's overall balance between research and development, staff commitments and administrative costs; it is also important to ensure that projects with restricted funds be aligned with World Agroforestry Centre's strategic research goals. (page 40)</i>	Accepted	The Gregerson review of 2007 endorsed the Centre's new modalities of science involvement with development projects, and noted that the Centre's approach could be a model for the CGIAR system in this area. The Centre's involvement with the Millennium Villages Project has been modest and has deployed the new modalities that are being used as the basis for all such engagements. Implementation of Centre science through development projects will continue to be reviewed regularly through the Centre's Science Quality Group and the Board review processes, including future CCERs.	Completed	
Recommendation 3 <i>World Agroforestry Centre merges its south Asia and South East Asia programmes into an Asia Region, with liaison units posted in India and China with clearly stated roles. (page 46)</i>	Agreed to study the issue and explore alternatives	Programmatic alignment between the two regions has been achieved through the Strategic Plan by early 2008, and formal inter-regional planning processes have now been established. Of even greater importance to the Centre is the possibility for programmatic and administrative alignment in these regions with CIFOR; a joint CCER with CIFOR has been commissioned on this topic by the two Boards for implementation in 2008.	Completed	
Recommendation 4 <i>World Agroforestry Centre ceases to maintain Latin America as a Region but instead retains a liaison unit there, associated with the Amazon Initiative. (page 48)</i>	Accepted	Completed 2007 with the alignment of all World Agroforestry Centre work in Latin America under the auspices of the Amazon Initiative.	Completed	

Recommendation as listed in EPMR Report	World Agroforestry Centre Response Accepted or not accepted	Implementation		
		Milestones	Progress Achieved	Target Date of Completion
Recommendation 5 <i>World Agroforestry Centre maintains its role in ASB. The Panel concurs that the capacity developed in ASB should be sustained and strengthened to maintain a global platform in which World Agroforestry Centre's innovative research can be validated and implemented. (page 55)</i>	Accepted	Completed in 2007; a new ASB Coordinator was appointed, a new strategic direction for the Programme was approved by the Global Steering Group (GSG), the World Agroforestry Centre DG was elected as Chair of the GSG. ASB was also recommended to continue as SWEF. It will work closely with CIFOR on the successful development of the REDD agenda for the tropical forest margins.	Completed	
Recommendation 6 <i>The CGIAR commission an external review of the AHI Systemwide Program to seek answers to the questions raised by the Panel and make recommendations on the future role of World Agroforestry Centre in the AHI. (page 57)</i>	Accepted	IDRC has supported the completion of an external review of AHI during the 1 st half of 2008. Discussions are in progress with ASARECA and national partners to refresh the mandate of AHI as a lead mechanism for developing methodological approaches to participatory NRM in the CGIAR in general and in the Eastern and Southern Africa Collective Action Platform.	Ongoing	Mid -2008
Recommendation 7 <i>World Agroforestry Centre Board and management strictly enforce their 'zero-tolerance' approach to staff and service providers who transgress the rules and procedures governing the use of the Centre's resources, taking prompt, decisive and unambiguous action when malfeasance has been established; the results should be communicated (with appropriate safeguards) to all Centre staff and other parties affected. (page 78)</i>	Accepted	Completed, 2006. New Code of Conduct and whistle-blowing policies were adopted and communicated to all staff. The Centre's zero-tolerance approach has continued to be applied, but with faster application in all cases arising.	Completed	
Recommendation 8 <i>Major risk factors be discussed thoroughly at the Board of Trustees (BoT) level and risk management becomes a standing agenda item for each session of the full BoT. (page 78)</i>	Accepted	Completed 2006; Board responsibility for risk management signed annually by the full Board, reports by management are discussed in detail by the Audit Committee and reviewed by the full Board at every meeting.	Completed	

Recommendation as listed in EPMR Report	World Agroforestry Centre Response Accepted or not accepted	Implementation		
		Milestones	Progress Achieved	Target Date of Completion
Recommendation 9 <i>A review by the CGIAR audit unit of World Agroforestry Centre management's BoT secretariat policies and management's procedures including, but not limited to, the production and dissemination of documents for all board meetings, to provide a foundation for the most expeditious possible improvement programme. (page 80)</i>	Accepted	Completed 2006; The recommendations were adopted by the Board in 2007.	Completed	
Recommendation 10 <i>World Agroforestry Centre engage the services of an independent, appropriately qualified and experienced management consultant to work with the three most senior levels of management to clarify and strengthen their respective roles and responsibilities, and to establish appropriate managerial processes. (page 82)</i>	Accepted	Coaching programme was implemented throughout 2006 and completed in 2007. A new senior leadership team has been instituted in 2008. The final report of the executive coach is discussed below.	Completed	
Recommendation 11 <i>World Agroforestry Centre urgently recruits a qualified and experienced professional Human Resources Manager, whose training and experience cover the entire spectrum of HR services, including staff management, staff development, but also compensation and benefits. (page 63).</i>	Accepted	New HR Manager was appointed in 2007. HR policies and practices are being aligned with those of ILRI. Discussions are in progress with ILRI for their new HR Director to lead in developing the joint higher-order HR strategic issues between the two Centres.	Completed	
Recommendation 12 <i>World Agroforestry Centre appoints a suitably qualified and experienced Chief Operations Officer (at the level of ADG-Operations) with overall responsibility for Financial Services, Human Resources, Operations, a Joint Services Unit to be established with ILRI and all other administrative services. (page 102)</i>	The response to this recommendation will be addressed jointly with the response to recommendation 15 (see below).	Completed, 2007; a new Director of Finance and Operations was appointed to the SLT in 2007; HR oversight is with the DDG; Joint Services alignment with ILRI has been proceeding smoothly since 2006.	Completed	

Recommendation as listed in EPMR Report	World Agroforestry Centre Response Accepted or not accepted	Implementation		
		Milestones	Progress Achieved	Target Date of Completion
Recommendation 13 <i>The Office of Strategic Initiatives be repositioned as a unit reporting directly to the DG and assisting the Office of the DG principally in resource mobilization and external relations. (page 101)</i>	Accepted	Completed 2007.	Completed	
Recommendation 14 <i>A Joint World Agroforestry Centre-ILRI Corporate Services Unit be established as soon as possible, including IT, Research Support and Communications. (pages 58, 59, 66, 69)</i>	Accepted	Completed for the joint IT Unit in 2007; completed for the Research Methods Group in 2007; a new Communications Director was recruited in 2007, and use of the CGIAR Media Unit at ILRI has recommenced.	Completed	
Recommendation 15 <i>World Agroforestry Centre moves to the following revised organizational structure and staffs it appropriately. (page 102)</i>	Accepted. This response relates to both recommendations 12 and 15.	Completed 2006, and has been further refined with the installation of the new SLT in 2008. The Board reviewed and approved each stage of the restructuring processes in 2006, 2007 and 2008.	Completed	



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