WORLD AGROFORESTRY CENTRE
ANNUAL REPORT 2005

Agroforestry science to support the Millennium Development Goals
About the World Agroforestry Centre
The World Agroforestry Centre is part of The Alliance of the CGIAR Centres — a global network of 15 centres, funded by the Consultative Group on International Agricultural Research (CGIAR).

We are an autonomous, not-for-profit research and development institution supported by over 50 different governments, private foundations, regional development banks, and the World Bank. The Centre was founded in 1978, initially as the International Council for Research in Agroforestry (ICRAF), to promote the exchange of information on agroforestry research in the tropics. The Council was created in response to a visionary study led by Canada’s International Development Research Centre (IDRC), which coined the term ‘agroforestry’.

In 1992, ICRAF joined the CGIAR and, in the years since then, has transformed itself into a world-class international agricultural research centre. In order to more fully reflect our global reach, as well as our more balanced research and development agenda, we adopted a new brand name in 2002 — ‘World Agroforestry Centre.’ Our legal name — International Centre for Research in Agroforestry — remains unchanged.

Our vision is an Agroforestry transformation in the developing world - a massive increase in the use of working trees on working landscapes by smallholder rural households that helps ensure security in food, nutrition, health, fodder, shelter and energy, income and a regenerated environment.

Our mission is to advance the science and practice of agroforestry to help realise an Agroforestry transformation throughout the developing world.

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Articles: World Agroforestry Centre staff
Compiled by: Rebecca Selvarajah-Jaffery and Bob Wagner
Editors: Rebecca Selvarajah-Jaffery, Bob Wagner and Ed Sulzberger
Technical editor: Anne Marie Nyamu
Photos: World Agroforestry Centre staff
Front cover design: John Gikang’a
Layout: Martin Serem
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World Agroforestry Centre (ICRAF)
United Nations Avenue, Gigiri
P. O. Box 30677-00100
Nairobi, Kenya.
Website: www.worldagroforestry.org

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Contents

From the Board Chair & Director General ............... 2

Introduction:
Trees of Change – a new era for Agroforestry ........ 4

Highlights of 2005 .................................................... 10

Projects list 2005 .................................................... 16

Tree science and innovations for small holder
Agroforestry
What's in your chocolate? ........................................ 19
ICRAF research supports traditional medicine ........ 21

Agroforestry science and practice beyond the
farm scale
Smallholder timber is big business in India ............... 23
FLCs: Taking agricultural innovations to the farmer’s
backyard.............................................................. 24

Demonstrating impacts of Agroforestry
NSS: Land rights and dignity for Indonesia’s
agroforesters ........................................................ 27
Measuring the benefits of agroforestry in Zambia .... 28

Agroforestry and environmental sustainability
Using trees to mitigate climate change ................... 31
IR diagnostics: a powerful tool for agriculture ......... 33

Selected publications 2005 .................................. 36

Performance indicators ......................................... 44
Board statement on Risk Management .................... 45
Investor support 2005 .......................................... 46
Financial summary 2005 ...................................... 48
Staff list 2005 ........................................................ 49

The Alliance of the CGIAR Centres ...................... 54
Contact us ........................................................... 55
Where we operate ............................................... 56
Today, many arguments are being recycled to describe Africa’s bleak prospects for economic growth and development. Those of us who work in Africa, however, see things differently.

We have strong confidence in the future of the continent. For all its problems, Africa is moving steadily to strengthen its democratic institutions, cast off the failed policies of the past, and make new investments for the future. Indeed, most of the governments that the World Agroforestry Centre collaborates with are working hard to grow their economies, improve governance, and reduce poverty.

What we are seeing now is a recognition that economic growth depends not only on better governance and a stronger commitment to grassroots development, but also a much greater investment in research — to enhance productivity and sustain the natural resource base upon which sustained growth depends. Most African governments are tackling these issues, and taking better advantage of new commitments from the international donor community.

Today, economists marvel over Asia’s economic trajectory. But three decades ago, there was great and pervasive pessimism about that continent’s prospects. Thus, there are lessons to be learned from Asia’s experience. And the evidence clearly shows that it was massive investment in developing smallholder agriculture, based upon the best of agricultural research, which provided the foundation for growth throughout Asia.

Currently, smallholder agriculture provides employment and income for three-quarters of the poorest of Africa’s population. If the Asian experience is any guide, Africa’s first priority is to reinvigorate its smallholder agriculture and take better care of its natural resource base. Through initiatives such as those of NEPAD and FARA, most of Africa’s leaders have come to recognize that agricultural development and environmental stewardship are prerequisites for prosperity. Moreover, they understand that the technologies developed for Asia’s Green Revolution are unsuited for direct application to Africa’s unique conditions. They are turning instead to new approaches such as agroforestry — approaches that address production issues, livelihoods and environment all at once.

This makes science-based agroforestry a key element in achieving the Millennium Development Goals in Africa. We believe that the greater integration of trees into African farming systems is a sound basis for a sustained agricultural revolution that goes beyond the Green Revolution — that looks to an Evergreen Revolution founded upon productive, diverse rained smallholdings.

Evaluation studies conducted over the past two years show that hundreds of thousands of African farmers are now using new agroforestry practices that have emerged from the research of the World Agroforestry Centre and its partners — practices that were developed and refined with farmers on their fields during the past two decades. Many times that number are seeking seed to scale up these practices. To assist them, scores of public sector and non-governmental organizations are building their capacity to expand the adoption of these innovations.

Agroforestry focuses on the many types of working trees that farmers fit into their farming systems to enhance food security, nutrition, income, health, and energy supply, and help sustain their land’s productive potential. Starting from the initial dramatic results from research in Southern and Eastern Africa, agroforestry is gaining popularity across the continent. A major part of that effort will focus on the use of integrated methods of enhancing
soil fertility to raise crop production with only modest inputs of inorganic fertilizers. The most advanced fertilizer tree systems that are now available have overcome the problems of too much labour and competition with crops. They transfer atmospheric nitrogen into the soil, basically putting the job of producing fertilizer into the hands of African farmers. Tests show that under most conditions, fertilizer trees will produce a minimum of 50 to 100 kilograms of nitrogen per hectare per year, and enable food crop yields to increase by 100 to 300 percent while steadily increasing soil health (see page 28 for the full story).

We also anticipate major increases in the number of farmers using ICRAF-developed fodder tree systems that improve dairy production. These are now becoming very popular among East African farmers. Similarly, by 2010 we foresee large numbers of farmers planting diverse portfolios of newly domesticated fruit and medicinal species that can be grown in the homestead to enhance child nutrition, and prevent and treat diseases such as malaria. The story on Artemisia-based herbal combination therapies on page 23 highlights this exciting work.

The income-generating potential of basic food crop commodities has been falling in Africa as elsewhere around the world. A new approach is needed to reduce dependency on primary agricultural food commodities as a source of farm income. African agriculture needs more opportunities for producing higher-value products that are linked to the continent’s growing urban markets, and to international markets. The development of new tree products, and the expansion of their markets, has great potential to provide new income solutions.

To realize agroforestry’s potential, additional research will be needed to understand where agroforestry innovations can best provide high-impact solutions. Thus, in collaboration with national systems, we are planning to conduct a series of studies in Africa’s most significant hunger hotspots. The objective will be to determine precisely where agroforestry innovations are most likely to be adopted and how large the payoffs will be. With that information, we should be well positioned to help African governments make better policy decisions and help national researchers produce the next generation of agroforestry technologies that will accelerate impact on an even greater scale.

As we examine our collaborative advantages as a research for development institution, we note that our fundamental strength is in addressing complex, integrated problems — problems that require the deployment of interdisciplinary teams of scientists, development specialists and educators. Our success will be measured by the degree to which we can provide systems solutions through agroforestry science.

For example, we now have at our disposal new tools to quickly help assess the quality of soils at a large scale, and guide interventions to halt land degradation. These include infrared scanning methods to collect data on many parameters of soil quality and plant nutrition — much more rapidly and inexpensively than ever before. With these tools, soil data can be monitored at thousands of locations, geo-referenced, and predictions made for appropriate management. The new techniques, which are now being field tested in several countries, will benefit not only work on agroforestry, but also assist in many other aspects of agricultural and natural resources research and development.

Given these promising advances, and despite the magnitude of the problems that Africa faces, we cannot think of a time since Asia’s Green Revolution that Africa’s prospects for agricultural development were more promising. Our Centre’s vision is to help create an agroforestry transformation that results in a massive increase in the use of working trees on working landscapes by smallholder rural households. And we intend to ensure that many new science-based agroforestry innovations will be available to accomplish this, thereby assisting Africa to meet its great potential for productive and sustainable agriculture and to achieve the Millennium Development Goals.

Eugene Terry
Chair - Board of Trustees

Dennis Garrity
Director General
Trees of change
A new era for agroforestry
An introduction to the World Agroforestry Centre

*Moringa oleifera* is a small, graceful, deciduous tree with sparse foliage. Research has proven that its leaves are a powerhouse of nutritional value, containing vitamins A and C, protein, calcium and potassium.

INSET: The tasty, blue safou fruit is harvested from the tree *Dacryodes edulis* – indigenous to the humid tropics of Central Africa.
In 2005, the World Agroforestry Centre (ICRAF) unveiled a new 10-year (2005–2015) vision for a global Agroforestry Transformation throughout the developing world. The new vision, communicated in the form of a modest 38-page publication entitled ‘Trees of Change’, builds on nearly three decades of agroforestry research, development-support and education programmes. ICRAF’s experience has shown that the science of agroforestry can play a significant role in creating innovative solutions to the increasingly complex problems faced by smallholder farmers. These include the challenges posed by widespread poverty, hunger and malnutrition, and land tenure conflicts. In addition, global climate change, land degradation, and loss of biodiversity are pervasive problems that require immediate attention.

Agroforestry is ready to be mainstreamed into global and national efforts to reduce poverty, improve food security, and sustain newly emerging environmental management agendas. The Centre and its partners are positioned to foster impacts that will help achieve the Millennium Development Goals (MDGs), benefit tens of millions of people living in rural areas, and stabilise the fragile environments from which they earn their livelihoods. The groundwork has been laid, but much remains to be done to institutionalize agroforestry in the world’s development agenda. This will be key to ICRAF’s role in fostering an Agroforestry Transformation.

Trees of Change describes the role that science-based agroforestry can play in meeting key international objectives and how developing countries can use agroforestry to achieve many of the MDGs.

The context for an Agroforestry Transformation

Why do we aspire to an Agroforestry Transformation in the developing world? The rationale is founded on three basic considerations:

1. The growing importance of trees and tree-based systems in sustaining agroecosystems;
2. ICRAF’s experience and comparative advantage for advancing the discipline; and
3. The evolving global focus on the Millennium Development Goals as the basis for transforming lives and landscapes.

Trees play a crucial role in almost all terrestrial ecosystems and provide a wide range of products and services to rural and urban people. As natural vegetation is cleared for agriculture and other types of development, the benefits that trees provide are best sustained by integrating them into agriculturally productive landscapes. This is, in essence, the foundation of agroforestry.

What have we learned from nearly three decades of agroforestry research, development-support and education at ICRAF? Our research has generated the basic scientific underpinnings of agroforestry as a modern approach to increasing agricultural and farm-forestry productivity. It has generated many useful technological options, and has enhanced the evolution of policy and institutional innovations, which are being scaled-up to millions of farms through our support to education. This, in turn, has benefited millions of poor people (impact). Although we fully recognize that a successful Agroforestry Transformation will take time to create, our experience over the past three decades suggests that its realization will build on three well-established and tested principles:

- that increased knowledge about trees and tree-based systems will enhance their adoption for improved farm productivity for food, nutritional, income, and health security, in a sustainable environment;
- that creating appropriate enabling environments will foster effective transfer of agroforestry technology and practices for wider application by farmers; and
- that integrating tree-based systems into agricultural, environmental and development planning and implementation at local, national, regional and global levels will create opportunities to generate major public goods from agroforestry.
As an international agricultural research centre, ICRAF’s work is focused primarily on the three goals of the CGIAR: food security, poverty alleviation and environmental sustainability. Our evolving 2015 strategy remains strongly aligned with the evolving priorities of the CGIAR as articulated in the draft report on system priorities recently prepared by the Science Council.

Finally, the MDGs are at the heart of the global agenda for addressing the poverty–environment–human development nexus. ICRAF’s 2015 strategy will embody the aspirations of the global development community by focusing on the MDGs as a centrepiece of our agenda. We have identified several key global challenges, related to the MDGs, to which we aim to contribute, including soil fertility replenishment and land regeneration for improved food production; generating income and building assets; improving the health and nutrition of the rural poor; conserving biodiversity, protecting watersheds and adapting to climate change through agroforestry-based solutions, and building human and institutional capacity in agroforestry research, development and education.

Our vision, mission and goals

Our Vision is an Agroforestry transformation in the developing world resulting in a massive increase in the use of working trees on working landscapes by smallholder rural households — that helps ensure security in food, nutrition, income, health, shelter and energy and a regenerated environment. Underpinning this transformation is the imperative of accelerated scientific research that ensures that the stream of necessary technical, policy and institutional innovations is forthcoming.

Our Mission is to advance the science and practice of agroforestry to help realize this Agroforestry transformation throughout the developing world. Our mission is about turning our vision into reality by mobilizing the best possible expertise, tools, approaches and principles to foster innovations that will increasingly transform lives and landscapes. This mission is driven by four goals and corresponding strategic objectives:

Goal 1. Enhanced smallholder access to high-quality tree germplasm and expanded market opportunities for smallholder tree products

New strategies and methods enhance tree product markets and expand the domestication of useful species, leading to more diverse cultivation systems that improve livelihoods and protect farmers from crop failure and market fluctuations. The strategic objectives for this goal are to: improve markets for tree products, focusing on those that favour small-scale farmers and entrepreneurs; support sustainable seed and seedling supply systems and improve the management of genetic resources of agroforestry trees; support and expand the domestication of valuable indigenous tree species that intensify and diversify tree cultivation systems; and facilitate farmer-led development, testing and expansion of tree-based options.

Goal 2. Advanced understanding of the role of trees in sound, and more productive, land and farm management and more integrated farming systems based on appropriate tree enterprise portfolios for key agro-ecological domains

Appropriate options for land management depend on a far better understanding of the short- and long-term role of trees in landscapes and small-scale agriculture. This enables deployment of appropriate and integrated solutions through productive and diverse tree enterprise portfolios in key farming systems. Strategic objectives include the development of integrated management systems for soil health and soil fertility that improve food productivity on smallholder farms, support for farmer-led development of agroforestry systems that conserve soil and water and maintain productive agricultural landscapes, improved tree-crop–livestock management in agroforestry systems and policies that improve land management practices through the involvement of disadvantaged land users in technology development.

Goal 3. Increased land access and recognition and rewards to smallholders for providing local, national and global environmental services through appropriate agroforestry strategies

Smallholder agroforestry systems can generate substantial environmental benefits at both local and global levels. Our strategic objectives within this goal are to develop pro-poor strategies to enhance watershed functions (for example, through negotiation support systems, see page 27), better use and conservation of biological diversity in multifunctional landscapes,
climate change mitigation and adaptation for rural development and harmonized policies for environmental stewardship and rural development.

Goal 4. Improved capacities for effective research, development and education in agroforestry — for a wide range of individuals and institutions in the developing world — to support an agroforestry transformation

Strengthening the capacity of regional, national and local institutions will foster better planning and will leverage the ability of stakeholders to generate and apply innovations in agroforestry and integrated natural resource management (INRM). The strategic objectives in capacity building are to strengthen research institutions and systems that foster the best agroforestry science and practices; backstop educational institutions and systems that teach agroforestry in the context of INRM; expose development systems and institutions, particularly farmer- and community-based organizations to natural resource management, to agroforestry options; and foster more effective and dynamic inter-institutional collaboration and knowledge management among research, development and education institutions.

Cross-thematic issues

Our new vision places a greater emphasis on women in agroforestry, and on the links between agroforestry and health and nutrition. Agroforestry offers many entry points to improve the status, income, and health of women and children. Our research on gender and agroforestry examines these issues, exploits key entry points by which women’s property rights can be enhanced, and enriches household tree enterprise portfolios that address their nutritional, health and income needs, while reducing their heavy burden of daily chores.

Advances in agroforestry have strong links to improving the health and nutrition of the rural poor. Work with national partners to domesticate nutritious indigenous fruits seeks to save these species from overexploitation, and develop them for local and regional markets. In addition, our work on natural medicinals has major implications for the treatment of malaria and other diseases. These efforts will contribute to the Millennium Development Goal of reducing child mortality.

Framework for implementing the new vision

ICRAF has established mechanisms for setting priorities, undertaking innovative and integrated research, forging partnerships and alliances, and focusing on impact. The substantive aspects in each of these areas are elaborated in our strategic planning framework. The Centre is streamlining its rolling Medium Term Plan to take on board new challenges and opportunities.

Another major component of our operational framework is engaging with national and regional policy-making processes, such as national poverty reduction strategy papers. ICRAF will assist its partners in developing national agroforestry strategies, convening national agroforestry working groups, putting environmental management and food security policies into practice, and creating roles for tree-based systems in economic recovery and poverty-reduction strategies.

At the global level, ICRAF will reinforce its efforts to mainstream agroforestry within major sectoral policies. We believe that a growing appreciation of the role of agroforestry in industrialized countries will enhance understanding and support for its expansion in developing countries. That, in turn, should help ensure that the needed investments will be forthcoming to deliver on our goals and enhance the promise of agroforestry to contribute to achieving the MDGs. ICRAF will also seek to enhance synergies through agroforestry between the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change and its Clean Development Mechanism, the United Nations Convention to Combat Desertification and the United Nations Forum on Forests.

We will reinforce the Centre’s strong participation in CGIAR system-wide initiatives. ICRAF hosts two CGIAR system-wide and ecoregional programmes with strategic links to the science processing ‘Heart of palm’ in Peru. This delicacy is obtained from the trunk of the Peach Palm (Bactris gasipaes) — indigenous to the Upper Amazon, where it has been domesticated for several centuries.
and practice of agroforestry: the Alternatives to Slash-and-Burn Programme and the African Highlands Initiative. Both programmes embody the principles of integrated natural resource management that are at the heart of our Research–Development–Education agenda. In addition, ICRAF will strengthen its engagement in the implementation of CGIAR Challenge Programmes.

**Themes for learning, integration and synthesis**

To accomplish the Centre’s mission goals, our work is pursued through four global themes:  
- **The Trees and Markets Theme** focuses on the key tree commodities and their value-added products.
- **The Land and People Theme** focuses on improving the household farm system by integrating trees into farm enterprise portfolios that address family needs.
- **The Environmental Services Theme** focuses on enhancing the landscape-level effects of agroforestry systems.
- **The Strengthening Institutions Theme** focuses on building capacity at all levels to facilitate knowledge creation and the uptake of science-based agroforestry systems.

All four themes incorporate research, development and education. Research projects are implemented to accomplish our goals. They are pulled by the development needs of local communities and are propelled by a science push. The four global themes extend across six regions to ensure that regional and thematic objectives are coherent.

**Priority geographic niches**

Globally, our organizational framework extends across Africa, Asia and South America, focusing on six regions where poverty, food insecurity, and environmental degradation are most acute.

**AFRICA**

Forty-eight percent of the people of Africa are desperately poor, the highest proportion of any region in the world. Food production per capita is declining, and malnourishment and poverty continue to increase. The global community is beginning to mobilize to address this intolerable situation, and the Centre is well-placed to contribute to this effort. ICRAF currently invests three-quarters of its income in African regional programmes.
East Africa — This programme focuses on densely populated degraded highland areas, including the Lake Victoria Basin and the major watersheds and water towers of national and regional significance. The programme places increasing attention on the drylands of Ethiopia, Kenya, and Tanzania. Strategies have included soil fertility management approaches that involve the use of fast growing legumes combined with inorganic fertilizers; high value timber, fruit and medicinal trees that can be integrated into smallholder production systems and fodder trees and shrubs.

Southern Africa — Over the past 20 years, ICRAF and its partners developed low-cost agroforestry practices geared to the needs of smallholder farmers in the region. Fertilizer trees are notable among the portfolio of new agroforestry technologies, but research also includes domestication of indigenous fruits of the ‘miombo’ woodlands, and fodder and timber improvement.

West and Central Africa (WCA) — This region combines two agro-ecological zones of major importance for agroforestry: the Sahel, and West Africa’s humid tropical lowlands. ICRAF’s work in the Sahel focuses on the semi-arid parkland ecosystem to improve farmer incomes and reduce threats from desertification through agroforestry-based innovations that combine scientific knowledge with farmers’ traditional knowledge and expertise. In the humid tropical lowlands, research focuses on the improvement, management, and marketing of indigenous plants and their products to benefit smallholder farmers, especially women.

ASIA

Southeast Asia — In East and Southeast Asia we concentrate on integrating productive trees into agroforest landscapes that provide important environmental services. We coordinate a network that seeks to Reward Upland Farmers for Environmental Services by investigating the nature of these services and evolving the basis for the recognition of rights and the transfer of benefits. These advances are often based on the deployment of negotiation support systems, a methodology that the regional team has developed to provide a science-based approach to managing trade-offs among competing interests in the management of critical upland environments. Our programmes span from the island nations of Indonesia and the Philippines to the montane southeastern Asian mainland, including Thailand, Laos and Vietnam and the watersheds of southwestern China.

South Asia — The South Asia region is ICRAF’s newest regional programme. The opening of a regional office in India in 2003 formalized our presence. The regional programme has identified opportunities for research and development in four eco-regions: the mountainous region of northeast India, Nepal, Bhutan and parts of Bangladesh; the Indo-Gangetic Plain of Bangladesh, India, Pakistan and Nepal; the humid coastal areas of India, Bangladesh, the Maldives and Sri Lanka; and the semi-arid lands of India, Sri Lanka and Pakistan.

LATIN AMERICA

In Latin America our focus is on land use in forest margins of the Amazon basin, the largest remaining tropical rainforest in the world. Our work is integrated into the Amazon Initiative — a consortium including all of the Amazon basin countries — which we facilitate with CIAT. The consortium focuses on research and development to reverse and mitigate natural resource degradation, while improving the livelihoods of the rural poor. Agroforestry is a key land use alternative for achieving these objectives. Our research on tree domestication for smallholders in the western Amazon is a major contribution to the Amazon Initiative agenda.

Trees of Change is clear evidence of ICRAF’s readiness to mainstream agroforestry as a scientific discipline to tackle complex problems associated with poverty, food insecurity, and environmental degradation. ICRAF has cooperative advantages as a global convener for agroforestry research, development and education, including the coordination of several global and regional networks related to agroforestry, and deep involvement with key global conventions related to sustainable development. The Centre is well positioned to influence the global research and development agenda in agroforestry, particularly in the developing world. We are proud to be the main conservator of key global collections of agroforestry germplasm. We have a robust research infrastructure on the ground in key hot spots of rural poverty through six regional programmes and in key focal countries in each region. On the basis of these strengths we are prepared to pursue our vision of an Agroforestry Transformation throughout the developing world.
ICRAF featured in TIME magazine and the New York Times
Fertilizer trees, a scientific farming approach developed by the World Agroforestry Centre that can triple maize yields, was highlighted in TIME magazine of 14 March 2005 (The end of poverty) and the New York Times of 5 May 2005 (A better way to fight poverty).

60 million USD for the Western Kenya Integrated Ecosystem Management Project
Kenya Country Director of the World Bank, Colin Bruce, pledged $60 million to the Western Kenya Integrated Ecosystem Management Project (WKIEM). WKIEM is already slated to receive USD 4.1 Million in funding from The Global Environment Facility (GEF), while the Government of Kenya plans to contribute 120 million KSh ($1.5 million). WKIEM is a Kenya Agricultural Research Institute (KARI) led initiative.

ICRAF in the limelight at the massive IUFRO gathering
The seven papers involving ICRAF staff and board, and the fruit poster from the East and Central Africa region, were backed up by a high-impact display booth at the five-yearly IUFRO Congress. Our theme was ‘The Future of Timber is On Farms’. The stand attracted thousands of visitors who went away with positive impressions. The booth hosted the premier screening of our new multi-media presentation on smallholder timber — a joint effort with FAO, Winrock and BOKU University.

The joint Centre for Mountain Ecosystem Studies opens in China
The Vice-President of the Chinese Academy of Sciences, Prof Chen Zhu, opened the new Centre for Mountain Ecosystem Studies (CMES), jointly hosted by the Kunming Institute of Botany and ICRAF China. CMES provides a platform for national and international research on mountain ecosystem resources in China and Southeast Asia.

Alliance with Conservation International
The World Agroforestry Centre and Conservation International (CI) have formed a partnership aimed at using science-based research to save species and improve livelihoods of rural communities. Under a Memorandum of Understanding between the Centre and CI, signed at CI headquarters in Washington DC, in June 2005. The two organizations will focus efforts on high-biodiversity wilderness areas, in particular the Amazon, and the world’s biodiversity hotspots — areas identified by CI as top conservation priorities because of high numbers of plant and animal species under threat.

Generous support from IFAD for ICRAF’s Sahel work
A grant of US$1.45 million was approved for the World Agroforestry Centre to support the ‘Programme for Strengthening Livelihood Strategies in the West African Sahel through Improved
Management and Utilization of Parkland Agroforests. The programme will benefit poor farmers in Burkina Faso, Mali, Niger and Senegal by helping to improve the management of indigenous trees and shrubs and by increasing biodiversity.

**BASIC Programme Development Workshop**

Building Africa’s Scientific and Institutional Capacity (BASIC) is a new initiative led by FARA and ANAFE, aimed at strengthening African leadership in the design and implementation of capacity building in agriculture and natural resource management. The BASIC Programme Development Workshop was convened by FARA and hosted by the Commission of the African Union in Addis Ababa, Ethiopia.

**Training course strengthens farmer- and NGO-operated tree seed supply enterprises**

In connection with the National Movement for the Rehabilitation of Forest and Land Rehabilitation, the Directorate of Forest Tree Seed, and Director General of Land Rehabilitation and Social Forestry (LRSF), ICRAF SEA organized a training course on Tree Seed Business Development in Alas Ketu, Central Java.

**SII Training Workshop in Belem, Brazil**

The international training workshop: Agroforestry promising initiatives to counter environmental degradation in the Amazon, took place in Belém and Tomé-Açu, Brazil, from January 19-28, 2005. The event assessed the opportunities and challenges for the use of agroforestry systems as a viable land use alternative for the Amazon. Organized by ICRAF and EMBRAPA, and sponsored by the SII project from the Dutch Government, the workshop was of great relevance to researchers and technicians, who had an opportunity to analyze the diverse factors that contribute to the sustainability of AFS, and to producers, who were able to disseminate their successful experiences to a broad audience including some 90 representatives of seven South American countries.

**ASB receives 2005 CGIAR Partnership Award**

On 7 December, 2005, ASB was awarded the CGIAR Science Award in the Outstanding Partnership category. ASB (Partnership for the Tropical Forest Margins) is an ICRAF-hosted institution and the only global partnership devoted entirely to research on the tropical forest margins. ASB’s 2005 External Review, led by Harvard University’s William Clark, observed that ASB’s goal is: “of great importance for the world, (and is) well aligned with the Millennium Development Goals for the reduction of poverty and hunger (MDG 1) and ensuring environmental sustainability (MDG 7)”. The review team concluded that the partnership continues to be highly relevant to the CGIAR’s goals and is pursuing work that fits well with the Science Council’s new research priorities, notably Priority 4a, “Integrated land, water and forest management at landscape level.” All ASB partners — over 80 worldwide — should take pride in this prize: tangible recognition of the talent and many years of dedication of the hundreds of scientists, policymakers, practitioners, and local people who have contributed to ASB’s success.

**International smallholder timber production workshop**

The Trees and Markets Team in collaboration with FAO, ITTO, IUFRO and BOKU University hosted an International Workshop on Smallholder Timber Production at the Centre’s Nairobi campus. Discussions focused on the need to develop a clear understanding of the role of smallholder timber production and how it integrates with national and international timber supplies from natural forests and large-scale plantations. It also demonstrated how timber growing by small-holders can benefit national forestry plans and poverty reduction strategy processes, and how smallholder forestry can better contribute to the UN Millennium Development Goals.

**Workshop on agroforestry regulations in the Sahel**

This regional workshop to assess land use policy in Burkina Faso, Mali, Niger and Senegal took place in June 2005, in Dakar, Senegal. Drawing over 30 participants from national, regional, international organizations and the local press, the workshop was sponsored by IDRC of Canada, l’Institut Sénégalais de Recherches Agronomiques (ISRA), the Direction des Eaux, Forêts, Chasses et la Conservation des Sols of the Ministry of Environment.
and Nature Protection of Senegal, ICRAF and DMP. It was part of an IDRC-funded project aimed at increasing biodiversity in agroforests to benefit rural people in the Sahel.

**Landcare International:**

**Development of the Landcare Facilitating Unit (LIFU) and up scaling of landcare activities in Africa**

2005 saw the establishment of a facilitation unit for Landcare International to help coordinate vigorous international exchange of information, capacity building, and research in Landcare. The Landcare International Facilitating Unit (LIFU) is an integral part of this and the executive arm of Landcare International (LI). ICRAF headquarters in Nairobi, Kenya through its programme themes, Land and People and Strengthening Institutions, is currently hosting the LIFU.

**ICRAF in the Philippines and AECI sign a new MOA**

ICRAF Philippines and the Government of Spain, through the Agencia Española de Cooperacion Internacional (AECI), approved the implementation of Phase 2 of the project ‘Support for Decentralized Tree Seed Systems and Improved Community-based Forest Management in Central Visayas and Mindanao, Philippines.’ Starting on 1 October 2005, the 18-month long phase will focus on conservation of indigenous tree species through cultivation and use, the development of decentralized tree seed systems and working models for community-based forest management areas.

**2006 IPCC Guidelines for National Greenhouse Gas Inventories**

ICRAF Philippines, together with the Intergovernmental Panel on Climate Change (IPCC) National Greenhouse Gas Inventories Programme Technical Support Unit, organized the 2006 IPCC Guidelines for National Greenhouse Gas Inventories - Sixth Authors/Experts Meeting at the Trader’s Hotel in Manila. Scientists and representatives from governments, and international NGOs attended the meeting to prepare the Draft Guidelines for National Greenhouse Gas Inventories. Among the lead authors are ICRAF’s Rodel Lasco, Philippine Program Coordinator, and Louis Verchot, Lead Scientist for Climate Change and Soil Fertility.

**New grant for SEANAFE Phase II projects**

The Southeast Asian Network for Agroforestry Education (SEANAFE), comprising 76 universities and colleges working together to strengthen natural resource management education, secured a new four-year grant of USD 1.6 million. Currently covering Indonesia, Laos PDR, the Philippines, Thailand and Vietnam, the programme will be expanding to include China and Malaysia. The next generation of activities for SEANAFE will include a series of well-defined regional projects focused on marketing Agroforestry Tree Products, landscape agroforestry, and forestry and environmental policies.

**External Programme and Management Review Gets Under Way**

The panel of the 3rd EPMR of the World Agroforestry Centre was finalized during the year, and the first phase of the review was convened at the Centre’s headquarters in November, 2005. The panel was chaired by Professor Jeff Burley of the Oxford Forestry Institute.

**Technology for sustainable agriculture workshop**

The internationally-known research programme operated at Yurimaguas in the northern Peruvian Amazon by the National Agricultural Research Institute (INIA) and its partners (initially, North Carolina State University and later ICRAF) has generated many technological innovations. However, the innovations have not been adopted in Yurimaguas itself. In response to this, ICRAF-Peru, with the support of INIA, organized a workshop in Yurimaguas (12–15 September 2005) to identify priorities for the region. The outputs of the workshop will be used in the preparation of funding proposals aimed at capitalizing on the opportunities of infrastructural development and mitigating the adverse impacts of the Yurimaguas-Tarapoto corridor in the northern Peruvian Amazon.
Study trip to the Amazon

From 30th May to 1st June 2005, a global World Bank team of senior operational staff, working on issues pertaining to agriculture and rural development, visited the Amazon to learn from the experiences gained in Brazil on agriculture, and rural and sustainable natural resource development. Participants explored field-based research and development programs of the Brazilian National Agency for Agricultural Research (EMBRAPA) in the Amazon — on improved tropical forest management, agroforestry, tree, crop, and livestock systems, non-timber forest products and community based natural resource management. The programme, organized by CIFOR and EMBRAPA, also included seminars at EMBRAPA-Belém and field visits to wood processing plants, upland and riverine agriculture, and commercial soybean farms.

Phase II of the ICRAF-IFAD project to fight poverty in West and Central Africa is launched

Phase II of the ongoing ICRAF-IFAD project to fight poverty in West and Central Africa by cultivating trees for home use and markets was launched in Yaounde, Cameroon. Phase II of this project will, amongst other objectives, ensure the planting and integration of 350,000 high-value trees into farming landscapes in five West and Central African countries.

ICRAF African Humid Tropics (AHT) features on BBC Earth Report

A documentary on sustainable agriculture practices was aired on the Earth Report, BBC World television programme. The broadcast included coverage on the different propagation techniques used by ICRAF AHT to quickly multiply and improve the quality of high-value medicinal plant and tree species, and how farmers are putting them into practice to improve their livelihoods.

ANAIFE has a new name and logo

ANAIFE now stands for the ‘African Network for Agriculture, Agroforestry and Natural Resources Education’. The change springs from the decision taken at the 4th General Meeting in April 2003 to adopt a more comprehensive and integrated approach, including all aspects of land use education.

Workshop on developing tree seed business linkages

The general objective of this workshop held in Bogor, Indonesia, was to strengthen the capacity of NGOs and farmer groups in developing tree seed supply enterprises. Thirty-seven farmers, NGO staff and government forestry officers participated in the workshop. The ICRAF SEA desktop publishing unit trained the participants to develop, design and publish marketing materials.

Amazon Initiative Cooperation Agreement signed

The AI Consortium was formalized during CGIAR 2004 AGM in Mexico City — when representatives of the six National Agricultural Research Institutions (Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela), four CGIAR Centers (ICRAF, CIAT, CIFOR, and IPGRI), and IICA signed the AI Cooperation Agreement. The agreement established a seed-money contribution of US$10,000 by each AI founding institution for activities targeting the institutional process of the AI.

Conservation Agriculture Congress hosted by Africa

The Third World Congress on Conservation Agriculture, IIIWCCA, was convened at Safari Park Hotel, Nairobi in early October 2005. It was hosted and arranged by the African Conservation Tillage Network, ACT, Harare, a close long term partner to RELMA, in close cooperation with the Kenyan Government (MoA) and ICRAF; NEPAD was a main political supporter. Some 700 people from more than 60 countries participated. More than hundred papers were presented and discussed under the Congress theme: ‘Linking Livelihood, Production and Conservation’. ICRAF had a booth and held a special session on possible links between agroforestry and conservation agriculture. Two ICRAF directors, Dennis Garrity and Mohamed Bakarr were key panel speakers.
ASB partners look into the future across the tropics

In 2005, ASB partners helped plan a new community forestry project in Rondonia, Brazil, eased conflict in the Mae Khon Kha watershed in Thailand, involved children views in a community development project in Piura, Peru and raised awareness on the environmental and social impacts of paving a road in Ucayali and Madre de Dios, in the Amazon of Peru. ASB partner teams led the organization of participatory scenarios in these sites. The project, which includes both the training of scenarios facilitators in 2004 and the 2005 workshops, was made possible through the financial support of the Netherlands’ Government and the efforts of ASB partners.

Capacity building of national partners, local actors and NGOs in INRM principles and approaches

AHI initiated a comprehensive regional training initiative in 2006 to take methods developed in collaboration with national partners in AHI’s benchmark sites to the ASARECA region at large. Four regional training events were conducted in 2006 involving participants from 9 ASARECA countries with the support of the EU. Topics ranged from farming system intensification to participatory integrated watershed management, tracking farmer to farmer sharing of introduced technologies and district-level partnerships for integrated NRM. AHI also contributed to the training of district extension officers from two new districts in Southern Ethiopia (Alaba and Dale) in sustainable land management in collaboration with the International Livestock Research Institute (ILRI-IPMS) and Ministry of Agriculture, Ethiopia.

INIA-Spain sponsors the Amazon Initiative

The first Amazon Initiative grant was successfully negotiated with INIA-Spain during the CGIAR 2004 Annual General Meeting. A proposal for the institutional development of the AI was submitted to Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA-Spain) in November 2004. INIA provided initial funding to the amount of US$200,000 (disbursed to CIAT, CIFOR, and ICRAF) for activities to be carried out in 2005. INIA renewed its support in December 2005 (equal amounts and receiving centres), and provided additional funding in June 2006, totaling US$600,000 to date.
Male flower and bud of Allanblackia stuhlmannii – a tree whose seeds yield a unique quality, edible oil. The species is being domesticated by ICRAF in collaboration with Unilever and the World Conservation Union (IUCN).
Theme: Trees and Markets
ICRAF Project TM.1:
Market analysis and support to tree product enterprises
Project Goal: To improve the marketing of and demand for agroforestry tree products (AFTPs)

ICRAF Project TM.2:
Sustainable seed and seedling systems for sound conservation and use of genetic resources of agroforestry trees
Project Goal: To determine and encourage sustainable tree seed and seedling systems and wise management of agroforestry tree genetic resources.

ICRAF Project TM.3:
Tree domestication with intensification and diversification of tree cultivation systems
Project Goal: To encourage farmers to cultivate superior trees to improve the productivity, profitability and diversity of individual agroforestry tree species and tree cultivation systems including peri-urban systems

ICRAF Project TM.4:
Farmer-led development and scaling up of tree-based options
Project Goal: To develop agroforestry practices and facilitate their wide-scale adoption for improving rural livelihoods

ICRAF Project TM.5:
Enhanced utilization of tree diversity at the landscape level
Project Goal: To improve farmers’ livelihoods by promoting the better utilization of tree diversity at landscape levels within agricultural systems

Theme: Land and People
ICRAF Project LP.1:
Improving Rural Livelihoods through Integrated Soil Fertility Management
Project Goal: To identify the principles for using agroforestry systems in integrated soil fertility management strategies of smallholder farming systems.

ICRAF Project LP.2:
Conserving soil and water for productive agricultural landscapes
Project Goal: To identify the principles for integrating agroforestry into soil and water conservation strategies.

ICRAF Project LP.3:
Sustaining productive farming systems through improved agroforestry management
Project Goal: To identify the principles for managing agroforestry systems in order to enhance crop and livestock productivity and resilience.

ICRAF Project LP.4:
Reaching the poorest land users with land management interventions
Project Goal: To mainstream a pro-poor research and development agenda into agroforestry innovations for improved land management.

Theme: Environmental Services
ICRAF Project ES.1:
Watershed management: Pro-poor strategies to enhance the positive contributions of agroforestry to watershed functions
Project Goal: Pro-poor watershed management programmes enhance the positive contributions of smallholder agroforestry systems to valuable watershed functions.
ICRAF Project ES.2:
Use and conservation of biological diversity in multi-functional landscapes
Project Goal: Agroforestry systems contribute to the conservation and enrichment of biodiversity in landscape mosaics that integrate protected areas with agriculture and other resource uses.

ICRAF Project ES.3:
Climate change mitigation and adaptation for rural development
Project Goal: Agroforestry systems contribute simultaneously to buffering farmers against climate variability and changing climates and to reducing atmospheric loads of greenhouse gases.

ICRAF Project ES.4:
Environmental policy: Harmonizing policy for environmental stewardship and rural development
Project Goal: Multi-lateral, national and local policies and programmes are designed to better harmonize goals related to environmental stewardship and sustained and equitable rural development.

Theme: Strengthening Institutions

ICRAF Project SI.1:
Strengthening agricultural research institutions and systems
Project Goal: Research partners in developing countries have the capacity to carry out agroforestry research and to share results with among others, educational and development institutions.

ICRAF Project SI.2:
Strengthening the agroforestry capacity of development institutions and systems
Project Goal: Improved adoption of agroforestry innovations by farmers.

ICRAF Project SI.3:
Strengthening educational institutions and systems
Project Goal: To improve opportunities for future generations to derive quality livelihood from agriculture - Well prepared policy makers, scientists, educators development workers and future farmers.

ICRAF Project SI.4:
Fostering inter-institutional collaboration and knowledge management
Project Goal: To develop mechanisms and tools that foster better sharing of agroforestry knowledge systems and innovations.

AHI Projects

Project 1: Support is provided by AHI partners to local policy makers and development stakeholder groups/organizations to improve their analysis, formulation and implementation of improved institutional arrangements and policies that reverse land and biodiversity degradation and improve livelihoods.

Project 2: AHI partners develop and use an integrated, participatory INRM approach and associated methods to develop and adapt practical technologies and practices that improve land use, increase returns to land and labour, arrest land and biodiversity degradation in highland watersheds and empower/build capacity of local communities to sustain these efforts.

Project 3: Strengthen the capacity of NARS, and other service provider institutions to use integrated, participatory NRM approach across the densely populated ecoregion ensuring that efforts to improve livelihoods and land management are sustainable by improving AHI knowledge management, coordination and information sharing mechanisms including incorporation of local knowledge.

ASB Outputs

ASB Output 1: Knowledge on development-conservation tradeoffs in the tropical forest margins
Knowledge generation and communication to influence science, policy, private sector, and public awareness of development-conservation tradeoffs and thereby raise the level of awareness of real challenges, public debate about alternatives, and support for appropriate policy reform and research, development, and education investments.

ASB Output 2: Global network for the tropical forest margins
Sustaining and developing the only global network devoted to work on the tropical forest margins. Development and diffusion of new organizational learning and change processes that link integrative science with policy and practice in the search for better approaches to poverty reduction, natural resource management, and rainforest conservation.

ASB Output 3: Enhanced capacity of partners to generate knowledge and develop workable interventions
Training and other investments to strengthen capacity of ASB partners to lead and sustain their own programmes of integrated assessment, research, development, communication, education and action for poverty reduction, natural resource management, and rainforest conservation.

ASB Output 4: Improved NRM practices and governance
Participatory development, diffusion, and broad adoption of new natural resource management practices, including improved germplasm, technological innovations, and institutional initiatives that improve rural livelihoods while conserving biodiversity and essential environmental services.

ASB Output 5: Improved natural resource management incentives
Create appropriate incentives and correct market failures so that rural people are rewarded for nurturing their land and forests.
Tree science and innovations for smallholder agroforestry

Harnessing quality tree germplasm and innovations for on-farm integration helps create options for smallholder farmers. ICRAF’s research on high value tree species in Africa — *Vitellaria paradoxa* (commonly known as shea) — is enabling impoverished rural farmers to tap into major international markets that source products from these trees. In addition, ICRAF’s work with several medicinal tree species is generating knowledge to support traditional health practitioners in curbing major diseases such as malaria. These studies are evidence of how ICRAF’s research is supporting progress toward achievement of Millennium Development Goals in Africa.

Shea nuts: these dried kernels of the shea fruit are roasted, then pounded in a mortar and ground to extract a clear oil, which cools to form shea butter

INSET: Shea fruit for sale
What’s in your chocolate?
Sahelian women sell more shea butter as science transforms the international value chain

Shea butter, also known as women’s gold, made from the nut of the shea tree, is rapidly becoming a valuable commodity in the global confectionary, cosmetic and pharmaceutical industries. ProKarité — a four-year project initiated by the World Agroforestry Centre and partners — works to develop the supply chain for shea products in order to increase returns to rural women producers in the Sahelian parklands.

The shea tree (Vitellaria paradoxa), indigenous to the agroforestry parklands of semi-arid Africa, has been a valuable asset for Sahelian women for many centuries. In addition to the many uses it provides in the form of food, nutrients and medicine from its kernels, shea nuts and shea butter are among the few significant sources of cash for rural woman in Sahelian West Africa. Today, shea butter in cosmetic products is acquiring customer recognition in developed countries and is eliciting a positive response as a natural, organic cream. At the same time, shea nuts have consolidated their status as the primary source of chocolate hardeners, and head the list of six species approved by the EU for use as cocoa butter extenders. The annual export market of shea butter is estimated at USD 30 million.

Although the value chain is fairly well developed regionally, increasing international trade further boosts smallholders’ income from shea butter. ‘The international trade is driven mainly by demand for shea butter as an alternative vegetable fat known as stearin,’ says Eliot Masters, Coordinator of ICRAF’s ProKarité partnership project with the Food and Agriculture Organization (FAO) of the United Nations, funded by the Common Fund for Commodities. ‘Because of its relatively low price, shea has become an attractive alternative for use as a cocoa butter additive and in the formulation of cosmetic products, thus presenting a great market opportunity for poor Sahelian women farmers’.

Tapping international markets demands adherence to rigorous quality standards. While major investments are being made to develop the international value chain, one important constraint is the availability of tools and methods for evaluating the quality and content of vegetable fat in shea butter. Such tools would enable producers to offer high quality shea butter to target markets.

‘Because the trees occur naturally across a huge swath of land extending nearly 6,000 km from east to west, there is considerable regional variation in the composition of shea nuts,’ explains Steve Maranz, ICRAF scientist attached to the ProKarité project. ‘By understanding the patterns of variation and establishing procedures and standards that are user friendly, producers stand to gain higher returns’.

Through the ProKarité project, Maranz and colleagues are meticulously evaluating and documenting the various provenances of shea trees in relation to the chemical composition of shea butter.

In one study, samples from trees in the parklands of Mali, Burkina Faso and Nigeria, were compared to those from Uganda. The compositional profiles showed high variability in three classes of oil-based compounds — plant sterols, triglycerides and fatty acids. ‘While the Ugandan provenances showed a dominance of oleic acid, which results in softer butter or liquid oil, the West African samples showed a dominance of stearic acid that is responsible for hard butter,’ notes Maranz. ‘Statistical comparisons of fat composition show that the geographic distance between shea tree populations is reflected in differences in their chemical profiles.’ This study is important to the cosmetic and pharmaceutical industries that are looking for natural ingredients with health properties and good formulating characteristics. Shea butter has an extremely high sterol content and a soft-to-hard texture, and is thus an ideal cosmetic base with the flexibility to be developed into different products or be sold in its pure form. The high sterol and antioxidant levels qualify shea butter as a bonafide ‘cosmeceutical’ — a cosmetic product with significant health attributes.

The ProKarité project is working in partnership with similar groups in Burkina Faso, Niger and Senegal. The project’s overall goal is to improve product quality and market access for shea butter originating from sub-Saharan Africa. It is being implemented in close partnership with national institutions, non-governmental organizations, and local farmer groups in all three countries.

For more information, contact:
Steve Maranz, s.maranz@cgiar.org
Eliot Masters, e.masters@cgiar.org

The MDGs
1 Eradicate extreme hunger and poverty
2 Achieve universal primary education
3 Promote gender equality and empower women
4 Reduce child mortality
5 Improve maternal health
6 Combat HIV/AIDS, malaria and other diseases
7 Ensure environmental sustainability
8 Develop a global partnership for development

This project contributes towards: 1, 2, 3, 4, 5, 6, 7
Artemisia annua, also known as Sweet Wormwood, Sweet Annie, or Chinese wormwood grows throughout the world. Artemisinin, extracted from its leaves, is used in anti-malarial drugs.
ICRAF research supports traditional medicine

Eighty percent of Africa’s people rely on traditional (primarily herbal) medicine for staying healthy. In recognition of this, in 2001 the World Health Organization declared 2000 to 2010 as the decade for African traditional medicine. Despite such wide recognition, traditional medicine has been largely ignored due to mistrust between conventional and traditional health practitioners. National policies vary greatly regarding the recognition and regulation of traditional medicine as part of the official systems of health care. Yet the HIV/AIDS pandemic and rising economic toll of malaria and other major diseases call for active inclusion of traditional medicines in health care systems. In May 2003, ICRAF teamed with a Ugandan-based NGO, and other partner organizations in East and Southern Africa, to bring a stronger scientific basis for herbal treatments in health promotion, and in prevention and care of killer diseases.

The Regional Initiative on Traditional Medicine and HIV/AIDS in Africa (RITMA) aims to define and adopt minimum standards of practice related to traditional medicine such as: the scientific validation of traditional remedies and their processing and packaging; the conservation of medicinal plants; and the protection of indigenous knowledge and intellectual property rights related to traditional medicine.

ICRAF hosted and cosponsored two RITMA meetings in 2005, one in February and the other in August. During the meetings, partners from 7 countries drafted a 5-year regional programme. The plan, based on the standards adopted in 2003, is to involve traditional health practitioners in preventing and treating HIV/AIDS, malaria, tuberculosis and other diseases. Achieving this will entail collaboration between traditional and modern health practitioners on several initiatives — evaluating the effectiveness of traditional herbal therapies; promoting the conservation of medicinal plants; and protecting indigenous knowledge and intellectual property rights related to traditional medicine, among others.

Plant resources: curbing decline

Increased use of traditional (herbal) medicine means higher demand for medicinal plant products. Two-thirds of these plants are trees and shrubs, typically collected from natural forests and woodlands. Unsustainable harvesting methods and increasing demand for these products are causing the rapid decline of the plant resources. ICRAF is spearheading efforts to conserve and cultivate medicinal trees in Africa with a broad range of partners.

Cultivation and conservation of medicinal trees is connected with documenting traditional knowledge. Efforts are under way to share knowledge and germplasm between countries — to bring the benefit of exotic plant species with great potential, such as Artemisia annua, to Africa. These efforts may soon contribute to several MDGs, especially goals 4 (Reducing child mortality) and 6 (Combat HIV/AIDS, malaria and other diseases).

ICRAF works with Action for Natural Medicine (Anamed), in Mozambique, to test propagation options for the Artemisia hybrids supplied by Anamed. Through Anamed, germplasm was sourced from Germany, Switzerland, Brazil and India to test in different agro-ecological zones. The goal is to identify and supply superior germplasm to farmers.

For more information, contact: Tony Simons, t.simons@cgiar.org

The Artemisia experience

Malaria kills an estimated 1 million people yearly. Over 200 million new infections take place every year in Africa alone. ICRAF and its partners have initiated activities to develop herbal-based combination therapies (HCTs) that would be as effective as artemisinin-based combination therapies (ACTs), and more accessible to farming households in Africa. While ACTs have renewed hopes for conquering the disease, the remoteness of many rural African communities hinders efforts to reach the infected in time. New products that farmers and traditional health practitioners can produce locally or access with ease are required.

ICRAF is concentrating on selecting quality germplasm with high artemisinin content and improved water solubility. As a first step ICRAF set up an Artemisia website to gather and share agronomic and pharmaceutical information on Artemisia.

The MDGs

This research contributes towards:

1. Eradicate extreme hunger and poverty
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Develop a global partnership for development
Agroforestry science and practice beyond the farm scale

Agroforestry is a practical option for addressing problems faced by smallholder farmers. In addition to this, the value-added aspect of agroforestry beyond the farm-scale is becoming increasingly apparent. ICRAF is beginning to evaluate the social, economic, and ecological potential of large-scale application of agroforestry practices in the tropics. In a recent study of smallholder timber in the Indian State of Haryana, ICRAF and partners have demonstrated that Poplar agroforestry systems are generating huge economic returns at the regional level. Generating such large-scale benefits requires major institutional innovations, which can be achieved through Farmer Learning Centres and strategic global partnerships for knowledge dissemination. This is consistent with the Millennium Development Goal on global partnerships.

Tree products — colourful, nutritious and inexpensive — add colour this market offering: Moringa (stick-like fruits on top), mangoes (golden yellow) and avocados.

INSET: Poplar and turmeric grow together in Haryana, India.
Smallholder timber is big business in India

The 1990s saw a revival of interest in timber tree planting in India’s Haryana state. Key stakeholders replaced semal (Bombax ceiba) with the poplar (Populus deltoids), leading to a boom in poplar and eucalyptus planting — which were integrated into existing cropping systems of the area. ICRAF and its collaborators undertook a study to evaluate the impact of smallholder timber production on farmer incomes, and the local and national economies, and found that the poplar is a critical income generator — not just for smallholder farmers, but also for related industries such as plywood, furniture making and haulage.

Following the introduction of a network of irrigation canals in the 1960s, the farmers of Haryana State were part of the Green Revolution and achieved significant increases in wheat and paddy production. But this provided only limited growth in income. With only 3.5% of its geographical area under natural forests, conscious efforts were subsequently made to introduce eucalyptus cultivation on field boundaries. When the first wood harvest was sold, land owners received unexpectedly high returns. The success by early adopters led to widespread plantations by farmers. Without diversified industrial uses, panic harvesting ensued and a consequent glut occurred in the market between 1980 and 1990. Revival of interest in timber tree planting by smallholders developed after its acceptance as a raw material by the plywood industry.

During the 1990s, the Indian Council of Forestry Research and Education, Uttar Pradesh Forest Department and West India Match Co. replaced semal (Bombax ceiba) with poplar (Populus deltoids) initially for matchstick making. Subsequently, poplar and eucalyptus planting boomed and was integrated into the existing rice-wheat based cropping system of the area. Given this phenomenal transformation, ICRAF and collaborators undertook a study to evaluate the impact of smallholder timber production on farmer incomes and local and national economies.

A boost for farmer incomes
The often asked question is how much difference in income exists between an agricultural crop system and an agroforestry crop system? On exceptionally well managed poplar agroforestry farms, an output of 50 metric tonnes per ha on a ten year cycle is often realized. Generally, about 20 m³ (equivalent of 12–16 tonnes) of wood is harvested per ha/year in the normally managed farming areas, with a minimum of 10 m³ of wood (veneer-grade timber) per year.

As for the financial returns, initially, the veneer-grade poplar timber was sold for USD78 per tonne, and the net additional income was USD194 per ha/year. These income figures are for average farms. At present, the poplar price has fallen to around USD44 per tonne. This has reduced the net additional earnings to about USD108 per ha/year. Nonetheless, because the tree requires very little labour or other input costs, it is still a critical income generator for smallholder farmers.

Regional economic impact
As of today, about 15 000 metric tonnes of timber are converted into plywood and panel boards in the 600 factories located in five states of Haryana, Punjab, Uttar Pradesh, Uttarakhand and Delhi. Although prices have fluctuated, this translates into as much as USD1 000 000 per day for the region’s smallholders. This figure is quadrupled in value at the factories that turn the timber into finished products. The Yamunanagar District in Haryana alone has a turn-over in raw material of up to USD500 000 a day.

In terms of labour, every tonne of wood harvested generates one personday in logging operations. Thus, every day 15 000 persondays of work are generated in five states of India, primarily in Haryana. In addition, the 600 factories employ about 60 000 full time workers. The transport sector also benefits, when bringing in raw material and taking out finished goods. With hauling costs at a rate of USD 7.00 per ton, the transport industry transacts USD100 000 per day through raw material transportation alone.

Eyes on the future
By harnessing the potential of agroforestry, timber and fuelwood can be generated far in excess of the projected requirements of the country. Haryana is a unique state in that it has more tree cover on farms than in forests. The successful agroforestry models developed in Haryana are being gradually adopted in adjoining states. These efforts are very dependent on the supply of good planting material, fair market policy and consistent R&D support.

ICRAF South Asia is collaborating with other partners on major research to diversify this system — by broadening the germplasm base, including fruit trees and medicinal species, and supplying of quality planting material, among other key activities.

For more information, contact: V.P. Singh, v.p.singh@cgiar.org

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8 Develop a global partnership for development
Farmer learning centres
Taking agricultural innovations to the farmer’s backyard

Research in agriculture and related fields is continuously yielding improved varieties of crops, more efficient ways to cultivate land, and better ways to harvest from the land while protecting it. But, do these advances reach impoverished rural farmers in good time? Don’t these farmers continue to cultivate their land using outdated implements, low quality seeds, and poor farming methods? ANAFE is testing ways to bridge this information gap. Farmer learning centres, in four African countries are engaging local communities, institutions of learning, NGOs and government extension arms to take relevant innovations to the farmers’ backyard — where they are needed the most.

In many parts of rural Africa, the extension system has collapsed, and although the private sector was expected to bring new technology to farmers, this did not happen. Most smallholder farmers simply don’t have money to pay for technology. Limited extension support, limited land resources, escalating fertilizer and livestock feed prices, and worsening poverty characterize most of sub-Saharan Africa, raising important questions about how information on sustainable agriculture can be relayed to farmers. The African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE) took on this challenge. Ideas and discussions merged into possible solutions and a remedy came into sight. Why not use the existing network of schools, universities and technical colleges in rural areas, set up relevant and beneficial projects in them, and use them as centres of dissemination? Thus the idea to form practical farmer learning centres (FLCs) emerged in 2003, with the following objective:

To establish demonstration facilities within schools for agroforestry technologies so that local communities can observe, choose and apply them, and:

- To improve effectiveness and relevance of tertiary education through experiential learning with farmers,
- To share innovations through simple and friendly delivery mechanisms within the farming environment, and
- To establish the possible role of schools in extension.

The concept is simple
Schools, colleges and universities link their teaching and learning to local communities. Through student projects and thesis work, they establish areas where farming innovations can be demonstrated. Farmers freely visit these sites, select the innovations they are interested in, and request training. With the help of state donors and supporting agencies, ANAFE has established four FLCs — in Mali, Malawi, Kenya and Cameroon.

Koulikoro, Mali
In Mali, ICRAF selected the Institut Polytechnique Rural de Formation et de Recherche Appliquée (IPR) to spearhead the FLC. School leaders, pupils and village leaders selected trees and shrubs from ICRAF’s research station in Samanko, then tasked IPR and Massala School to raise top-quality fruit and vegetable seedlings for use in a nearby village called Chô.

Massala School, located 5km from IPR on the bank of the Niger river, raises seedlings of Podocarpus erinarius, Lucaena leucocephala, Glinicidia sepium and Pilesolodium dulce for fodder, Eucalyptus camaldulensis and Lucaena leucocephala for firewood, and Ziziphus mauritiana, Adansonia digitata and Pilesolodium dulce for food — and sells them to the villages. The villagers eagerly purchase the seedlings as they promise better yields. A number of NGOs have expressed interest in the model and are adopting it.

The benefits are manifold
Chô village now has technical support from IPR, a source of top-quality seedlings, and villagers have an added and sustainable supply of nutrition for their families, and fodder for livestock. The environment is saved from rampant harvesting of young trees and shrubs.

Massala school has a learning programme on tree nursery establishment and management, a flourishing seedling enterprise that earns income for the school, and strong links with sources of knowledge (IPR and ICRAF). Pupils are engaged in a worthwhile activity, spending thirty minutes each day in the nursery. The youth in the school are developing life skills and becoming aware of biodiversity and environmental management issues.

IPR supports its education and extension linkages through the
Agroforestry science to support the Millennium Development Goals

project, gaining knowledge on cost effectiveness, technical viability, sustainability, strengths and bottlenecks of the model. These lessons are incorporated into its teaching programmes — flowing back to the community at large, as the institution disseminates the experience to other institutions in the Sahelian region.

**In Malawi**

Two primary schools and a village polytechnic host the resource centres around Zomba. The University of Malawi, ICRAF Makoka, and surrounding villages near the schools are participating in the model.

In the villages, mangoes were fetching very low prices while in season. The general practice was to collect them into huge piles and sell them at throwaway prices. The FLC provides training in the following:

- Sorting and grading mangoes and pricing them according to size and quality, thus improving income.
- Chipping and drying low quality mangoes for off season consumption.
- Making mango juice: the juice costs only 10% the price of soft drinks in Zomba.
- Planting passion fruit and grafted mangoes for juice production.

**A synergy of education and development**

- ICRAF Makoka supplies germplasm and trains farmers in agroforestry technologies.
- University of Malawi students carry out related research at the schools, Makoka and surrounding communities.

**In Kenya**

The FLC is based at the Baraka Agricultural Technical College, Molo. Farmers are trained on crop propagation and cultivation and their skills are strengthened. A demonstration area has been set up and each technology demonstrates itself. Farmers are free to visit the demonstration site, and graduate students train the farmers on their innovations of choice. The government extension system and Kenya Agricultural Research Institute are involved. ANAFE provides some financial and technical support.

**In Cameroon**

The FLC in Cameroon concentrates on the introduction of tree propagation technology, using Mist Propagation techniques. The project is located at Belo in Bamenda District, and is implemented in collaboration with MIFACIG farmers cooperative.

**The FLC model in Mali:**

- Farmers have unrestricted access to resource centres.
- The youth in schools are developing skills in fruit processing.

Graduate students train villagers as they learn and collect data for their theses. Neighbouring villages observe and adapt these good practices. Fruit losses are minimized and all partners value the business potential, in addition to the food security aspect.

*For more information contact:* August Temu, a.temu@cgiar.org

1 Eradicate extreme hunger and poverty
2 Achieve universal primary education
3 Promote gender equality and empower women
4 Reduce child mortality
5 Improve maternal health
6 Combat HIV/AIDS, malaria and other diseases
7 Ensure environmental sustainability
8 Develop a global partnership for development
Demonstrating impacts of agroforestry

As ICRAF’s research on agroforestry systems continues to generate knowledge, tools, and technology options, there is a growing need to understand how these innovations are impacting livelihoods and influencing policy. In a recent impact study in Southeast Asia, ICRAF and partners demonstrated evidence of major policy transformation as a result of negotiation support systems that enabled smallholder farmers to secure rights over land. In Southern Africa, a similar impact study on improved fallows demonstrated that social, economic and environmental benefits are now well manifested in Zambia. Such impact studies also demonstrate the global public good potential of agroforestry innovations in support of the Millennium Development Goal to reduce poverty and hunger.
Negotiation support system

Land rights and dignity for Indonesia’s agroforesters

Over the past decade, ICRAF’s ‘negotiation support system’ (NSS) has demonstrated the potential to improve the lives of tens of millions of resource-poor farmers on contested forest domains across the humid tropics. NSS has achieved ‘proof of concept’ through application in Indonesia and Thailand, and is now benefiting large numbers of poor people in areas where conflicts over land reinforce extreme poverty. Recent studies have confirmed the types, pathways and potential sustainability of those positive impacts.

Throughout much of Asia land is scarce. Governments exacerbate this scarcity by claiming large tracts of forest — placing them off limits to farming and settlement. Seventy percent of Indonesia is thus reserved, despite the fact that 50 million people currently inhabit these poverty-stricken areas.

In the early 1990s, ICRAF and its partners provided policy analysis to establish ad hoc agreements for community forest management, with Krui, along Sumatra’s west coast, as the starting point. These agreements were so successful that mechanisms for community-based forest management (‘Hutan Kemasyarakatan’ or HKm) were incorporated into Indonesia’s 1998 Forestry Law.

The Krui agroforests

The first test case for ‘negotiation support’ occurred in the mid-1990s when ICRAF joined other concerned organizations to establish a partnership to help resolve a longstanding conflict between the Indonesian government and thousands of agroforesters in Krui.

To the government, the farmers’ forest-like gardens with resin-producing Shorea javanica trees were ‘forest’ and thus eligible for logging or conversion to oil palm. The partnership resolved the conflict in a peaceful way and enabled farmers to assert land use rights for a sustainable production system.

In a formal impact assessment in 2005 of the 12 years of involvement in Krui, all stakeholders recognized the partnership as vital to success. The government’s 1998 decree enabled Krui communities to claim concession rights over state forest land, authorizing them to manage and benefit from their agroforests. Though the Krui communities have not formally applied for their concession rights, the decree has prevented outsiders from encroaching on these agroforests and provided adequate tenure security for farmers to continue investing in their agroforests. The agreement also protects the environment by disallowing logging concessions; an adjacent national park suffered less intrusion.

ICRAF and its partners challenged the scientific basis for the evictions — deeming them unnecessary for maintaining watershed functions — and helped local officials and farmers communicate more effectively. The farmers were transformed, in their own words, from ‘squatters fearful of eviction’ to ‘human beings with dignity’. Today, HKm agreements cover 70% of the ‘protection’ forest in Sumberjaya, providing 5-year (renewable) tenure security in exchange for sustainable management of forest land, and directly benefiting 25,000 people.

Five test groups, who signed agreements five years earlier, have recently passed a compliance review. One of them received a national award from Indonesia’s Minister of Forestry — evidence of support for conflict resolution at the highest government levels.

Sumberjaya as a test case for the HKm in protection forest

After HKm was incorporated into the law, ICRAF focused on implementation of the law and resolving conflicts between forest managers and local communities. ICRAF selected an area of Lampung Province called Sumberjaya — meaning ‘source of wealth’. Coined by migrant farmers decades ago, the name did not exactly live up to expectations. In four military-supported campaigns (1991–96), the government evicted thousands of families, burned their coffee farms, and destroyed lives, assets and livelihoods — purportedly to restore watershed functions for a new hydroelectric scheme.

According to policymakers, only people-free forests would guarantee regular, sediment-free flow of water.

Over the past decade, ICRAF’s ‘negotiation support system’ (NSS) has demonstrated the potential to improve the lives of tens of millions of resource-poor farmers on contested forest domains across the humid tropics. NSS has achieved ‘proof of concept’ through application in Indonesia and Thailand, and is now benefiting large numbers of poor people in areas where conflicts over land reinforce extreme poverty. Recent studies have confirmed the types, pathways and potential sustainability of those positive impacts.
Can large-scale agroforestry adoption have a mitigating effect on drought-induced crop failure and subsequent food insecurity? What are the macro-level economic and environmental implications, especially for smallholder farmers in marginal areas? As the scale of applied agroforestry practices increases in regions where ICRAF works, the need for answering such basic questions — by measuring the different benefits, to households, and beyond to the wider farming communities — becomes crucial.

On-farm tree fallows have been spreading across eastern Zambia for more than a decade, bringing multiple benefits to many thousands of smallholders.

In 2005, ICRAF scientists combined several existing studies with fresh analyses to generate a synthesis of the productivity, income, and natural resource impacts of improved fallow systems in eastern Zambia. The synthesis contributes to a CGIAR systemwide study of the impacts of natural resource management research.

ICRAF research on improved fallow systems began in 1987 in eastern Zambia. The Centre was invited to develop an agroforestry research programme at Msekera Research station outside of Chipata. Following successful on-station trials, further participatory research with farmers yielded several improved nursery and technology management options, including lower nursery costs, shortened fallow periods, and significant reduction in overall labour requirements. This set the stage for widespread adoption of the improved fallow system in cooperation with the Zambian extension system, development partners like World Vision, and community-based organizations across Eastern Province.

By 2004, the number of farmers planting an improved fallow had reached an estimated 77 500. In one World Vision project target zone of almost 90 000 households, 27% had planted an improved fallow by 2003. A study by Keil in 2001 showed that once started, most farmers continue to plant fertilizer tree fallows; 71% of a sample of farmers who planted fertilizer tree fallows in 1996/97 continued to plant them over the next three seasons. The size of area under improved fallow varies from farm to farm, but the average found in recent years was around 0.20 ha. Further studies have found that rates of use were high among both poor and women farmers.

Improved fallows benefit crop yields in many ways. Leguminous tree species fix atmospheric nitrogen and make it available to crops through their leaves at up to 150kg/ha. This essentially ‘free’ fertilizer value provides sustained increase in yields of crops that follow the fallows. In addition to increasing crop yields, improved fallows also provide reduced risk from drought, increased fuelwood and other by-products, such as insecticides made from Tephrosia vogelii leaves.

The main environmental benefits are improved soil physical properties, such as better infiltration and aggregate soil stability, which reduce soil erosion and enhance soil water absorption. For example, infiltration rates were more than twice as high as those in continuous maize cropping systems. Improved

Sesbania sesban is widespread in southern, central and eastern Africa. It is fast growing, vigorous, and easy to propagate and remove from the soil. It produces high-quality biomass, nodulates easily and fixes Nitrogen. Sesbania fallows also greatly reduce the occurrence of striga weeds, which thrive on infertile soils.
fallow systems also build up and store carbon in their stems and in the soil, of 2.5 to 3.6 tons/hectare after a 5-season rotation. Sesbania fallows were also found to greatly reduce the occurrence of striga weeds, which thrive on infertile soils.

**Economic impact**

Labour is an essential agricultural resource in small-scale farms in southern Africa where many farmers use little or no external resource inputs. Questions have been asked regarding how labour input requirements for fallows compare with the respective yields obtained from the systems. Furthermore, in view of the household labour impact of HIV/AIDS in Zambia, the labour requirements of soil fertility management is a key factor in farmers’ decision making regarding the appropriateness of agricultural technologies.

In terms of productivity increase, on-farm trials and surveys found that improved fallows greatly improve productivity as measured by yields, returns to land, and returns to labour. Cumulative maize yields from a 2 year fallow followed by 3 years of cropping were 7.2 tons/ha compared to just 4.2 tons/ha from 5 years of continuous cropping without inputs. Returns to labour were assessed to be between $1.90 and $2.50 per day for different improved fallow systems as compared to just $1.10 for low input maize production. Fertilizer systems are the best performing in terms of yields, but are only marginally better than improved fallows in terms of returns to labour.

When calculated on the basis of a 0.20 hectare fallow, it was estimated that improved fallows contributed about 100 persondays of extra maize consumption, greatly contributing to reducing hunger. This translated into about $28 per farmer using the system. With 77 300 farmers using the system, in 2005–06 it is estimated that the technology had an aggregate value of about $2.17 million. This figure is expected to grow as more farmers continue to take up the practice. When the research costs involved in developing the technology were considered, the annual benefits have exceeded the costs for several years and the cumulative benefits have surpassed costs in 2006. This take-off in Zambian farmers’ use of improved fallows has contributed greatly towards increasing crop yields, raising farmers’ incomes, and rehabilitating the natural resource base.

For more information, contact: Frank Place, f.place@cgiar.org
Agroforestry and environmental sustainability

As the global community grapples with major environmental challenges such as land degradation and climate change, ICRAF’s research is beginning to shed light on potential opportunities for harnessing agroforestry innovations to enhance environmental sustainability. In particular, ICRAF is exploring the use of trees in mitigating climate change. ICRAF is also mobilizing cutting-edge tools for rapid assessment and monitoring of land degradation patterns in order to better target land use options, including agroforestry. These areas of research constitute a major contribution to the Millennium Development Goal on achieving environmental sustainability.
Using trees to mitigate climate change

2005 was a turning point for global climate change issues: the Kyoto Protocol came into force, and through its Clean Development Mechanism (CDM), industrialized countries can meet part of their emission reduction commitments by assisting developing countries to achieve sustainable development while reducing greenhouse gas emissions. ICRAF scientists are working to study the possibilities of and constraints to smallholder carbon projects in the developing world, link this science to policy, provide support at global climate change fora, and help national organizations to plan specific projects eligible for carbon trading.

Rising energy prices, record temperatures, catastrophic hurricanes and a groundswell of local political action combined to make 2005 a year of global awakening to the realities and challenges of climate change. The Kyoto Protocol of the United Nations Framework Convention on Climate Change came into force on 16 February, 2005, establishing an international system of cap-and-trade in greenhouse gas emissions. This prompted an emission trading regime among the European signatories to Kyoto, and similar regimes in non-signatory countries (Australia and the United States).

ICRAF's work is helping to clarify and strengthen the potential for smallholder agroforesters to benefit from the Clean Development Mechanism (CDM) of the Kyoto Protocol. The CDM allows Annex I industrialized countries to meet part of their emission reduction commitments through projects that assist developing countries to achieve sustainable development while reducing net emissions of greenhouse gases. Afforestation and reforestation projects — including smallholder agroforestry projects — are encouraged under the CDM.

Working with a range of partners, ICRAF scientists are studying the possibilities of and constraints to smallholder carbon projects in the developing world. They are also actively engaged in linking that science to policy, addressing key questions about potential trade-offs associated with carbon sequestration through tree planting, supporting developing country negotiators at international climate change meetings, coordinating the CGIAR Inter-Centre Working Group on Climate Change, and helping national organizations to plan afforestation or reforestation projects eligible for carbon trading.

An oversupply of nitrogen?
ICRAF's research has begun to address two key questions about trade-offs associated with afforestation and reforestation for carbon sequestration. Nitrogen-fixing trees are an important component in many agroforestry systems, allowing continuous harvest of nitrogen-rich produce without the need for purchased nitrogen fertilizers. As the production of nitrogen fertilizer uses a lot of fossil energy, the promotion of nitrogen fixing crops and trees is supportive of ‘clean development’. However, a recent analysis conducted by ICRAF researchers and partners in Indonesia suggests that emissions of the greenhouse gas N₂O (nitrous oxide) can be high in coffee gardens that contain many nitrogen-fixing trees. N₂O emissions are high following deforestation when coffee gardens are being established, along with high rates of mineralization of soil organic matter. In more mature coffee gardens and in those without N-fixing trees, N₂O emissions are similar to forest emission levels. Further research to determine thresholds is needed, but there are clear environmental risks in oversupplying the soil system with nitrogen, whether from organic or inorganic sources.

Water: Tree-use versus downstream flow
A second question about trade-offs concerns water use by fast-growing trees. A global synthesis and meta-analysis published...
in a 2005 issue of Science summarizes a weight of evidence that plantation tree planting often leads to dramatic reductions in downstream stream flow (Jackson RB et al. 2005. Trading water for carbon with biological carbon sequestration, Science 310(5756): 1944–1947). A synthesis of research by ICRAF and other organizations suggests that these negative water balance effects of fast-growing trees such as clonal *Eucalyptus grandis* may be very important in water-scarce catchments across the tropics, including catchments where wet upland areas provide water to drier areas downstream. Planting deciduous trees that shed their leaves in times of water scarcity can offset this. With new measurement devices developed by ICRAF in partnership with the University of Western Australia, scientists are intensifying work in this area, seeking to quantify the seasonal water use of a range of tree systems, including popular evergreen species such as eucalyptus, deciduous indigenous trees, and bamboo.

**Clean development mechanism in practice**

These field measurements are complemented by a component of the ENCOFOR project that seeks to identify areas where there is high potential for carbon sequestration projects to have significant negative impacts on water supply. Through its collaboration in the ENCOFOR project, ICRAF is contributing to the development of a generic toolkit of CDM project design methods. In addition, ICRAF also supports national agencies in afforestation and reforestation projects in the tropical countries where we work. In the Philippines, ICRAF has produced a Primer on Climate Change Mitigation Projects and continues to provide scientific advice to community-based CDM tree planting projects under development by international and local agencies. In Indonesia, ICRAF and CIFOR have conducted an analysis of priority districts for CDM project development support, as well as scenario modelling tools for assessment of baselines, additionality and leakage.

These studies suggest that programmatic approaches to support tree planting, that remove constraints to the profitability of trees on farm, can yield substantially larger returns to farmers for given amounts of carbon, than project-based approaches that attempt to directly reward farmers for carbon. Overall, we remain optimistic that carbon trading schemes can provide a modest topping-up on the market-based benefits that trees provide to smallholder agroforesters, but only when appropriate incentive mechanisms are developed. In the long run our work will contribute to environmental sustainability (MDG 7) and developing a global partnership for development (MDG 8).

**For more information, contact:**

Meine van Noordwijk, m.van-noordwijk@cgiar.org,
Lou Verchot, l.verchot@cgiar.org,
or Brent Swallow, b.swallow@cgiar.org
Infrared diagnostics
A powerful analytical tool for agriculture

Efforts to increase agricultural productivity in much of the developing world are hampered by a number of factors — not least of which are degraded soils that are unable to sustain crops. Yet, agricultural productivity must be increased if the MDGs to eradicate extreme hunger and poverty, reduce child mortality, improve maternal health and combat diseases are to be achieved. ICRAF’s work in infrared spectroscopy is now enabling assessment and monitoring of soil quality on a scale previously unimaginable — assisting Kenyan scientists set targets for a World Bank-Global Environment Facility initiative, supporting a UNEP project in West Africa, a UNDP project in India, and the UN Millennium Villages Project in Africa.

Large increases in agricultural productivity, achieved in tandem with environmental protection, are essential to attaining the MDGs to reduce hunger and child mortality, combat disease and ensure environmental sustainability. This transformation, in turn, requires a marked advancement in our ability to diagnose constraints to agricultural productivity, and monitor the impacts of interventions. However, the analytical capacity of developing country laboratories is often severely constrained by limited physical and human resources.

To combat this, ICRAF is supporting the application of infrared spectroscopy (IR) in developing countries — as a tool for analysing the composition of biological materials. IR is a rapid, low cost and reliable analytical technology, requiring little or no sample processing and no chemicals. For these reasons it is already widely used for industrial applications, such as quality control in pharmaceuticals and food processing. The principle is simple — infrared light is shone onto a sample and the signature of reflected light at different wavelengths is captured on a computer as a reflection spectrum. Biochemical composition and many functional properties of biological materials can then be related to the spectral signatures using statistical algorithms. The robustness and simplicity of the technology makes it ideal for use under basic conditions.

IR in diagnosis of soil, crop and livestock health problems
There is an enormous range of applications for IR in diagnosis of soil, crop and livestock health problems, and quality control requirements in agricultural production and marketing. Though relatively new, use of IR for soil analysis is already enabling assessment of soil constraints and monitoring of soil quality on a scale previously unimaginable. Hundreds of soil samples can be analysed per day at one-hundredth of the cost of conventional

The infrared spectrometer being used to scan soil samples in a government soil laboratory in Mali. The same instrument can be used to assess plant health, seed quality, organic manures, feeds and fodder quality, quality of tree products, and livestock nutrition and health. Cost of the whole system is about USD 75 000

Map of soil organic carbon in the Nyando River Basin (2 500 km²), in western Kenya. The map was created using infrared spectroscopy to characterize soil samples from hundreds of georeferenced locations. A spectral indicator of soil carbon was then calibrated to Landsat satellite imagery.
analyses. Combined with remote sensing, this makes it possible to map out soil constraints over entire watersheds and help monitor impacts of interventions on soil quality.

**Broad application**
The effectiveness of the technique was first demonstrated in the year 2000 when ICRAF scientists uncovered massive amounts of soil flowing into Lake Victoria. The problem was all but unrecognized until the cost-effectiveness of IR made it possible to conduct a survey that pinpointed soil degradation in the 3,500 km² Nyando River Basin and assisted Kenyan scientists set targets for a World Bank-Global Environment Facility initiative. IR is now being used in this project to establish baselines and monitor soil organic carbon stocks and soil quality as part of efforts to develop schemes for environmental service payments to poor land users. IR is also being used to assess and monitor soil quality to help target interventions and assess project impacts in a UNEP project in West Africa, a UNDP project in India, and in the UN Millennium Villages Project in Africa.

IR analysis of organic resources and plant tissues can assist with targeting of soil and crop management recommendations and crop improvement programmes. Information on livestock health and range condition can be provided by IR analysis of livestock faecal samples. Water quality analysis is also possible. In addition, the technology can play a key role in adding value to agricultural produce through quality control, for instance with biofuels and other cash crops.

There is great potential for the widespread adoption of IR by public and private sector providers of on-farm advisory services and environmental protection agencies. For example, IR can be used to measure implementation of, and compliance with, environmental service payment schemes and to monitor good agricultural practice. As one example, ICRAF is working together with ICRISAT to help the Mozambique Government monitor impacts of cropping activities — by large-scale agricultural concession companies on soil quality using IR.

Using the same instrument for analysis of many different agricultural inputs and products reduces the need for large capital investments in testing laboratories. ICRAF is helping establish a network of IR laboratories in national agricultural research centres in Africa, beginning with Kenya, Mali and Mozambique. Over the next 10 years, scientists foresee developing countries building large networks of modest or mobile IR laboratories, supported by a few specialized regional laboratories for high quality reference analyses.

**Background link:**
http://www.cgiar.org/monthlystory/feb2006.html

**For more information, contact:**
Dr. Keith Shepherd, k.shepherd@cgiar.org

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1 Eradicate extreme hunger and poverty  
2 Achieve universal primary education  
3 Promote gender equality and empower women  
4 Reduce child mortality  
5 Improve maternal health  
6 Combat HIV/AIDS, malaria and other diseases  
7 Ensure environmental sustainability  
8 Develop a global partnership for development

The MDGs this research contributes towards
Soil samples waiting to be scanned at the ICRAF soil lab
Journal Articles


Hess, H.D., Noto, F., Tiemann, T.T., Franzel, S., Lascano, C.E., Kreuzer,


*(ICRAFP)*


Verbiest, B., Putra, A.E., Budidarsono, S. World Agroforestry Centre (ICRAF) - Southeast Asia, Bogor (Indonesia) 2005. Factors driving land use change: effects on watershed functions in a coffee agroforestry systems in Lampung, Sumatra. Agricultural Systems 83 (3) p.254-270. [2005041] ICRAFP


Books


**Book Chapters**


Hairiah, K., Noordwijk, M van, Weise, S. Brawijaya University, Malang (Indonesia) 2005. **Sustainability of tropical land-use systems after forest conversion.** Slash and burn: the search for alternatives. New York, USA. Columbia University Press p. 143-169. [2005094] ICRAF


Occasional Papers


Working Papers


Conference Papers


Mibile, P., Tchoundjeu, Z., Nchoutboube, J., Ndizomo-Abanda, G. World Agroforestry Centre (ICRAF), Yaounde (Cameroon) 2005. Community-based stock assessment and monitoring system (CB-SAMS) for non-


The fruit of the acacia is an unusual pod — bright orange to reddish-brown, thick and conspicuously curled and twisted. Tree products include food for human consumption, fodder, fuel, timber and medicine; it is useful for beekeepers in the Sahel as a source of pollen and nectar; also used to shade coffee and in reclamation, as the spreading root-system offers excellent protection to the banks of watercourses. It is also a fertilizer tree — shedding its leaves and boosting nutrients in the soil, and is useful as a boundary or ornamental tree.
World Agroforestry Centre Performance Indicators
(Results of the 2005 CGIAR Performance Measurement Exercise)

1. Outputs — 89% of acceptable output targets achieved.*

2. Outcomes — scored 15 on a scale of 0–15, where the higher the score the better the quality.

3. Impact — scored 5.9 on a scale of 0–10, where the higher the score the better the results.

4. Quality and relevance of current research:
   4A) Number of peer-reviewed publications per scientist in 2005 — 1.23 where the CGIAR average was 2.12.
   4B) Number of peer-reviewed publications per scientist in 2005 that are published in journals listed in Thomson Scientific/ISI (Indicator being tested) — scored 0.56 where the CGIAR average was 0.82.
   4C) Percentage of scientific papers per scientist that are published with developing country partners in refereed journals, conference and workshop proceedings in 2005 — 58.2 where the CGIAR average was 46.

5. Institutional Health
   1. Governance
      5A. Checklist on Centre governance — can be availed upon request.
      5B. Assessment of Board statements — scored 6.8, where the CGIAR average was 6.6.
   2. Culture of learning and change
      5C. Checklist on culture of learning and change — can be availed upon request.
   3. Diversity
      5D. Gender diversity goals — the centre has Board-approved gender diversity goals.
      5E. Percent of management positions occupied by women — scored 33% on a CGIAR average of 27%.
      5F. IRS nationality concentration — the two most prevalent nationalities represented on the IRS staff are USA (22) and UK (9).
      5G. Diversity in recency of PhDs (% of scientists receiving their PhD in the last five years (2001–2005) — scored — 20% on a CGIAR average of 19%.

6. Financial Health
   6A. Short term solvency (liquidity) — 160 days where 90–120 days is the recommended acceptable range.
   6B. Long-term financial stability (adequacy of reserves) — 94 days, where 75–90 days is the recommended acceptable range.
   6C. Efficiency of Operations (indirect cost ratio) — scored 29%, where the CGIAR average was 22%.
   6D. Cash Management on Restricted Operations — scored 1.02, where the CGIAR average was 0.9.

Stakeholder Perceptions
The results of the CGIAR’s 2006 Stakeholder Perceptions Survey can be availed upon request. They include:
   (1) Key findings and implications
   (2) Full Report on the CGIAR Overall and
   (3) Full Centre Report

*As a result of a Science Council review of Centre submitted outputs/output targets.
The Board of Trustees of the World Agroforestry Centre has responsibility for ensuring that an appropriate risk management process is in place to identify and manage major and significant risks to the achievement of the Centre’s business objectives, and to ensure alignment with CGIAR principles and guidelines as adopted by all CGIAR centres. These risks include operational, financial and reputation risks that are inherent in the nature, modus operandi and locations of the Centre’s activities. They are dynamic owing to the environment in which the Centre operates. There is potential for loss resulting from inadequate or failed internal processes or systems, human factors or external events.

**Risks include:**

- low impact science (and therefore irrelevance);
- misallocation of scientific efforts away from agreed priorities;
- loss of reputation for scientific excellence and integrity;
- business disruption and information system failure;
- liquidity problems;
- transaction of processing failures;
- loss of assets, including information assets;
- failures to recruit, retain and effectively utilize qualified and experienced staff;
- failures in staff health and safety systems;
- failures in the execution of legal, fiduciary and Centre responsibilities.

The Board has adopted a risk management policy — communicated to all staff — that includes a framework by which the Centre’s management identifies, evaluates and prioritizes risks and opportunities across the organization; develops risk mitigation strategies that balance benefits with costs; monitors the implementation of these strategies; and periodically reports to the Board on results. This process will draw upon risk assessments and analyses prepared by staff of the Centre’s business unit, internal auditors, Centre-commissioned external reviewers and the external auditors. The risk assessments will also incorporate the results of collaborative risk assessments with other CGIAR centres, System Office components, and other entities in relation to shared risks arising from jointly managed activities. The risk management framework seeks to draw upon best practices, as promoted in codes and standards promulgated in a number of CGIAR member countries. It is subject to ongoing review as part of the Centre’s continuous improvement efforts.

Risk mitigation strategies include the implementation of systems of internal controls, which, by their nature, are designed to manage rather than eliminate risks. The Centre endeavours to manage risk by ensuring that the appropriate infrastructure, controls, systems and people are in place throughout the organization. Key practices employed in managing risks and opportunities include business environmental scans, clear policies and accountabilities, transaction approval frameworks, financial and management reporting, and the monitoring of metrics designed to highlight positive or negative performance of individuals and business processes across a broad range of key performance areas. The design and effectiveness of the risk management system and internal controls is subject to ongoing review by the Centre’s internal audit service, which is independent of the business units, and which reports on the results of its audits directly to the Director General and to the Board through its Audit Committee.

The Board and the World Agroforestry Centre management have reviewed the implementation of the risk management framework during 2005 and the Board is satisfied with the progress made.

Signed: Eugene Terry
Chair, World Agroforestry Centre Board of Trustees
## Investor support 2005

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<td>Forum for Agricultural Research in Africa</td>
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<tr>
<td>Others (Less than 20,000 each)</td>
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<td>325</td>
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<td><strong>Total</strong></td>
<td><strong>9,540</strong></td>
<td><strong>21,014</strong></td>
<td><strong>30,554</strong></td>
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# Financial summary 2005

## INTERNATIONAL CENTRE FOR RESEARCH IN AGROFORESTRY

### STATEMENT OF FINANCIAL POSITION AS AT 31 DECEMBER 2005 and 2004 (In US Dollar '000)

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<tr>
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<td><strong>ASSETS</strong></td>
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<td>Cash and cash equivalent</td>
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<td>Accounts receivables</td>
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<tr>
<td>Donor</td>
<td>7,423</td>
<td>6,781</td>
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<tr>
<td>Employees</td>
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<tr>
<td>Other CGIAR centres</td>
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<td>Other</td>
<td>3,805</td>
<td>2,522</td>
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<tr>
<td>Inventories - net</td>
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<td>101</td>
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<td>Prepaid expenses</td>
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<td><strong>Total current assets</strong></td>
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<tr>
<td><strong>Non-Current Assets</strong></td>
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<tr>
<td>Property, Plant and Equipment - net</td>
<td>6,317</td>
<td>6,454</td>
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<tr>
<td><strong>Total Non-current assets</strong></td>
<td>6,317</td>
<td>6,454</td>
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<td><strong>TOTAL ASSETS</strong></td>
<td>31,324</td>
<td>31,638</td>
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<table>
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<tbody>
<tr>
<td><strong>LIABILITIES AND NET ASSETS</strong></td>
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<tr>
<td><strong>Current Liabilities</strong></td>
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<td>Accounts payable Donor</td>
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<tr>
<td>Other CGIAR centres</td>
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<tr>
<td>Other</td>
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<td>Accruals</td>
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<td>1,743</td>
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<td><strong>Total current liabilities</strong></td>
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<td><strong>Non-Current Liabilities</strong></td>
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<tr>
<td>Accounts payable Employees</td>
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<tr>
<td><strong>Total Non-current liabilities</strong></td>
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<td><strong>TOTAL LIABILITIES</strong></td>
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<td><strong>NET ASSETS</strong></td>
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<tr>
<td>Unrestricted</td>
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<td>Designated</td>
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<td><strong>TOTAL NET ASSETS</strong></td>
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<td><strong>TOTAL LIABILITIES AND NET ASSETS</strong></td>
<td>31,324</td>
<td>31,638</td>
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## STATEMENT OF ACTIVITIES For the Years Ended 31 December 2005 and 2004 (In US Dollar ‘000)

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2004</th>
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<tbody>
<tr>
<td><strong>REVENUE, GAINS AND OTHER SUPPORT</strong></td>
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<tr>
<td>Grant revenue</td>
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<td>29,891</td>
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<td>Total revenue and gains</td>
<td>9,997</td>
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<tr>
<td><strong>EXPENSES AND LOSSES</strong></td>
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<tr>
<td>Programme related expenses</td>
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<td>26,630</td>
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<td>Management and general expenses</td>
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<td>CGIAR Gender and diversity programme</td>
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<td>Total expenses and losses</td>
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<td>Overhead cost recovery</td>
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<tr>
<td>Total expenses and losses</td>
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<td>28,610</td>
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<tr>
<td><strong>NET SURPLUS</strong></td>
<td>521</td>
<td>1,796</td>
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Staff list 2005

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WARUHIU ANNABELLE NJOKI Executive Assistant — DG&DSI Nairobi, Kenya, HQ

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NG’ENY ALISON Internal Auditor Nairobi, Kenya, HQ

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MBUGUA LUCY Project Development officer Nairobi, Kenya, HQ

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Head, Communications Unit
Nairobi, Kenya, HQ

VAN OPZEELAND WALTER
JPO — Electronic Information Access & Development
Nairobi, Kenya, HQ

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Web Coordinator
Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

BUYSSE WIM
VVOB Training Associate
Nairobi, Kenya, HQ

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GIS Unit Manager
Nairobi, Kenya, HQ

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Chief Financial Officer
Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

MUOKI NZIOKA
Manager — Corporate Accounting
Nairobi, Kenya, HQ

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Manager — Financial Information Systems
Nairobi, Kenya, HQ

WAMBUGU JANE AMIMO
ECA Regional Finance Officer
Nairobi, Kenya, ECA

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Nairobi, Kenya, HQ

DE SOUZA MARGARET
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Nairobi, Kenya, HQ

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Network Administrator
Nairobi, Kenya, HQ

NGURI LAWRENCE
IT Site Manager
Nairobi, Kenya, HQ

SALIM AHMED
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Nairobi, Kenya, HQ

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Procurement Assistant — International
Nairobi, Kenya, HQ

MATEE FAITH NDUKU
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Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

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Nairobi, Kenya, HQ

PROTOCOL OFFICE
MBIRIRI GEORGE
Protocol Officer
Nairobi, Kenya, HQ

TRAVEL OFFICE
HAMOUD MAHMOUDA
Travel Officer
Nairobi, Kenya, HQ

THEME OFFICES
TREES AND MARKETS
SIMONS ANTHONY
Co-Theme Leader of the Trees and Markets/GRU Head
NAIROBI, KENYA, HQ

MUASYA STELLA
Project Officer
NAIROBI, KENYA, HQ

ORWA CALEB OBONYO
Database Assistant
NAIROBI, KENYA, HQ

MUNJUGA MOSES RUKWARO
Associate Scientist
NAIROBI, KENYA, HQ

CARSAN SAMMY
Scientific Assistant
NAIROBI, KENYA, ECA

KINDT ROELAND
Tree and Landscape Diversity Scientist
NAIROBI, KENYA, ECA

MURIUKI JONATHAN KIURA
Scientific Assistant
NAIROBI, KENYA, ECA

LAND AND PEOPLE
PLACE FRANK
Theme Leader of the Land and People
NAIROBI, KENYA, HQ

ABARU MILLIE
Collective Action and Markets
NAIROBI, KENYA, ECA

DAMGAARD-LARSEN SOREN
Development Specialist Conservation Agriculture & Soil Health
NAIROBI, KENYA, ECA

ENVIRONMENTAL SERVICES
SWALLOW BRET
Theme Leader of the Environmental Services/Principal Scientist
NAIROBI, KENYA, HQ

OGOLLA AILEEN KATHAMBI
Communications and Administrative officer
NAIROBI, KENYA, HQ

YATICH THOMAS T.B.
Research Analyst in Environmental Policy
NAIROBI, KENYA, ECA
### STRENGTHENING INSTITUTIONS

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<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Location</th>
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<tr>
<td>TEMU AUGUST</td>
<td>Theme Leader of the Strengthening Institutions</td>
<td>Nairobi, Kenya, HQ</td>
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<tr>
<td>BEKELE-TESEMA AZENE</td>
<td>Capacity Building Advisor</td>
<td>Nairobi, Kenya, ECA</td>
</tr>
<tr>
<td>CHAKEREDZA SEBASTIAN</td>
<td>Post Doctoral Fellow — Senior ANAFE Education</td>
<td>Chitedze, Malawi, SA</td>
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### TRAINING UNIT

<table>
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<th>Name</th>
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<tbody>
<tr>
<td>BENIEST JAN</td>
<td>Training Unit Manager — Principal Training Scientist</td>
<td>Nairobi, Kenya, HQ</td>
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<tr>
<td>VANDENBOSCH TOM</td>
<td>Coordinator, Farmers of the Future</td>
<td>Nairobi, Kenya, HQ</td>
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### REGIONS

#### SAHEL

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<th>Name</th>
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<tr>
<td>ADANEDJAN CLAUDE</td>
<td>Senior Education Fellow</td>
<td>Samanko, Mali, SAHEL</td>
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<tr>
<td>DEMERS NICOLE</td>
<td>Researcher</td>
<td>Segou, Mali, SAHEL</td>
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<tr>
<td>HAMEM ALRIK</td>
<td>JPO — Socioeconomist</td>
<td>Younde, Cameroon, AHT</td>
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<tr>
<td>IBRAHIM ALI GATTA</td>
<td>Administrator</td>
<td>Younde, Cameroon, AHT</td>
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<tr>
<td>KALINGANIRE ANTOINE</td>
<td>Ecologist/Interim Acting Regional Coordinator</td>
<td>Younde, Cameroon, AHT</td>
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<tr>
<td>KAYA BOCARY</td>
<td>Soil Scientist and National IER/ICRAF Coordinator</td>
<td>Younde, Cameroon, AHT</td>
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<tr>
<td>KEITA SOULEYMANE</td>
<td>Scientific Officer</td>
<td>Younde, Cameroon, AHT</td>
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<td>KONE BREHIMA</td>
<td>Scientific Officer</td>
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<td>MARANZ STEVEN</td>
<td>Postdoctoral Fellow</td>
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<td>SIDIBE MAMADOU MALICK</td>
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<td>Younde, Cameroon, AHT</td>
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<tr>
<td>TRAORE CHEICK OUMAR</td>
<td>Associate Scientist</td>
<td>Younde, Cameroon, AHT</td>
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<tr>
<td>DIALLO ROKIATOU</td>
<td>Finance and Admin Officer</td>
<td>Younde, Cameroon, AHT</td>
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#### AFRICAN HUMID TROPICS

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<th>Name</th>
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<tbody>
<tr>
<td>ANEGBENG PAUL</td>
<td>Tree Domestication Researcher</td>
<td>Onne, Nigeria, AHT</td>
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<tr>
<td>ASAAM BENEZAR K.</td>
<td>Associate Research Officer</td>
<td>Yaounde, Cameroon, AHT</td>
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<tr>
<td>FACHEUX CHARLY</td>
<td>Assistant Officer</td>
<td>Yaounde, Cameroon, AHT</td>
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<tr>
<td>HONORE TABUNA</td>
<td>Marketing Specialist</td>
<td>Yaounde, Cameroon, AHT</td>
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<tr>
<td>KAMGA ANDRE</td>
<td>Regional Administrator</td>
<td>Yaounde, Cameroon, AHT</td>
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<tr>
<td>KANMEGNE JACQUES</td>
<td>Production Ecology and Resource Conservation</td>
<td>Yaounde, Cameroon, AHT</td>
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<tr>
<td>MBILE PETER</td>
<td>Farmer Field Specialist</td>
<td>Yaounde, Cameroon, AHT</td>
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#### EAST AFRICA

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<td>JPO — Enterprise and Entrepreneurship in Agroforestry</td>
<td>Nairobi, Kenya, ECA</td>
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<td>AWITI ALEX ODHIAMBO</td>
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<td>BOFFA JEAN-MARC</td>
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#### LATIN AMERICA

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The World Agroforestry Centre is one of 15 food and environmental research organizations known as The Alliance of the CGIAR Centres. The centres, located around the world, conduct research in partnership with farmers, scientists, and policy makers to help alleviate poverty and increase food security while protecting the natural resource base. The centres are principally funded through the 58 countries, private foundations, and regional and international organizations that make up the Consultative Group on International Agricultural Research (CGIAR).

In 1998 the centres supported by the CGIAR created Future Harvest as a charitable and educational organization designed to advance the debate on how to feed the world’s growing population without destroying the environment, and to catalyse action for a world with less poverty, a healthier human family, well-nourished children, and a better environment. Now known as The Alliance of the CGIAR Centres, the group reaches out to media, academics, scholars and scientists in the world’s premier peace, environment, health, population, and development research organizations, as well as to policymakers and civil society, and enlists world-renowned leaders to speak on its behalf. The alliance raises awareness and support for research, promotes partnerships and sponsors on-the-ground projects that bring the results of research efforts to farmers’ fields in Africa, Asia, and Latin America.

**CGIAR Centres**
- CIAT — Centro Internacional de Agricultura Tropical
- CIFOR — Center for International Forestry Research
- CIMMYT — Centro Internacional de Mejoramiento de Maíz y Trigo
- CIP — Centro Internacional de la Papa
- ICARDA — International Center for Agricultural Research in the Dry Areas
- ICRISAT — International Crops Research Institute for the Semi-Arid Tropics
- IFPRI — International Food Policy Research Institute
- IITA — International Institute of Tropical Agriculture
- ILRI — International Livestock Research Institute
- IPGRI — International Plant Genetic Resources Institute
- IRRI — International Rice Research Institute
- IWMI — International Water Management Institute
- Africa Rice Center (WARDA) — West Africa Rice Development Association
- World Agroforestry Centre (ICRAF) — International Centre for Research in Agroforestry
- World Fish Centre — International Centre for Living Aquatic Resources Management
Contact us

HEADQUARTERS
World Agroforestry Centre (ICRAF)
United Nations Avenue, Gigiri
P. O. Box 30677-00100 Nairobi, Kenya
Tel: +254 20 7224000
+1 650 833 6645
Fax: +254 20 7224001
+1 650 833 6646
Email: icraf@cgiar.org
Website: www.worldagroforestry.org

REGIONAL OFFICES
EAST & CENTRAL AFRICA
MASENO
Nicholas Shitsukane
Maseno Regional Research Centre,
P.O. Box 25199, Kisumu, Kenya
Tel: 035 51164
Email: icraf-kisumu@exch.cgiar.org

MERU
ICRAF Meru office
P.O. Box 3208 Meru, Kenya
Tel: 064 31267
Email: icrafmeru@plansonline.net

African Highlands Initiative (AHI),
World Agroforestry Centre-ICRAF Uganda
Plot 13 Binayomba Road, Bugolobi,
P. O. Box 26416 Kampala, Uganda
Tel: (256) 1 461775 / 256 41 505021
Fax: 256 41 223242
Email: SNakabugo@cgiar.org

SOUTHERN AFRICA
MALAWI
Fannie P. Gondwe
Finance and Administrative Officer
World Agroforestry Centre
SADC-ICRAF
Chitedze Research Station
P.O. Box: 6226 Lilongwe 3, Malawi
Tel/Fax: (265) 1 707 332 / 319 / 323
Cell: (265) 9 557 612
Email: f.gondwe@cgiar.org

ZAMBIA
Gillian Kabwe
Country Leader,
Zambia-ICRAF Agroforestry Project,
c/o Provincial Agriculture Office (Eastern Province)
P.O. Box 510046 Chipata, Zambia
Tel: 260 62 21404
Fax: 260 62 21725
Email: gkabwe@zamtel.zm

MALI
Rokiaou Diallo
Sahel Regional Programme
c/o ICRAF
B.P. 320 Bamako, Mali
Tel: 223 223175 / 227707
Fax: 223 228683
Email: roudiallo@cgiar.org

SOUTHERN AFRICA
MALAWI
Fannie P. Gondwe
Finance and Administrative Officer
World Agroforestry Centre
SADC-ICRAF
Chitedze Research Station
P.O. Box: 6226 Lilongwe 3, Malawi
Tel/Fax: (265) 1 707 332 / 319 / 323
Cell: (265) 9 557 612
Email: f.gondwe@cgiar.org

ZAMBIA
Gillian Kabwe
Country Leader,
Zambia-ICRAF Agroforestry Project,
c/o Provincial Agriculture Office (Eastern Province)
P.O. Box 510046 Chipata, Zambia
Tel: 260 62 21404
Fax: 260 62 21725
Email: gkabwe@zamtel.zm

ZIMBABWE
Clever Zinaka, Admin Officer
World Agroforestry Centre (ICRAF)
Southern Africa Programme
SADC-ICRAF Regional Agroforestry Programme
P.O. Box MP 128, Mount Pleasant
Harare, Zimbabwe
Tel: 263 4 334202 / 334162
Fax: 263 4 310945
Email: accicraf@africaonline.co.zw

SOUTH EAST ASIA
INDONESIA
Josephine Prasetyo
Regional Administrator
Southeast Asia Regional Programme,
Jl. Cfir, Situgede, Sondangharang,
Bogor 16680, Indonesia
OR P.O. Box 161, Bogor 16001, Indonesia
Tel: (62 251) 625 415 / extension 735
Fax: (62 251) 625 416
Email: jprasetyo@cfir.exch.cgiar.org
General email: icraf-indonesia@cgiar.org

THAILAND
ICRAF, International Centre for Research in
Agroforestry
C/O Faculty of Agriculture, 5th Floor
Chiang Mai University
Chiang Mai 50202, Thailand
Tel: (66) 53 357906, 53 357907
Fax: (66) 53 357908
Email: icraf@chmai.loxinfo.co.th
pongicra@chiangmai.ac.th
Mailing address:
P.O. Box 267, CMU Post Office,
Chiang Mai 50202, Thailand
Where we operate

We work in six regions across Africa, America and Asia.

**Latin America**

Our focus in Latin America is on land use in the Amazon Basin, the world’s largest remaining tropical rainforest. Our work is integrated into the Amazon Initiative — a consortium that includes the Amazon Basin countries — which we facilitate along with our sister centre, the International Centre for Tropical Agriculture (CIAT). The Amazon Initiative focuses on research and development to reverse and mitigate natural resource degradation while improving the livelihoods of the rural poor. Agroforestry is a key land use alternative to achieve these objectives. Our research on tree domestication for smallholders in the western Amazon is a key contributor to the Amazon Initiative agenda.

**West and Central Africa**

This region combines two agroecological zones of major importance for agroforestry: the Sahel, and West Africa’s humid tropical lowlands. ICRAF’s work in the Sahel focuses on the semiarid parkland ecosystem to improve farmer incomes and reduce threats from desertification — through agroforestry-based innovations that combine scientific knowledge with farmers’ traditional knowledge and expertise. In the humid tropical lowlands, research focuses on the improvement, management, and marketing of indigenous plants and their products to benefit smallholder farmers, especially women.

**Southern Africa**

Much of Southern Africa is caught in the downward spiral of poverty — mainly because of land degradation, loss of soil fertility and depletion of renewable natural resources. High HIV/AIDS incidence also reduces family productivity and quality of life. Pressures on the natural ecosystem continue. Research by ICRAF and partners has shown that soil fertility can be restored significantly by planting nitrogen-fixing fertilizer trees. These trees are generally multipurpose, providing both fodder and fuelwood. The lack of livelihood alternatives for much of Southern Africa’s poor means that their future is directly tied to the land and its ability to sustain them. Scaling up of fertilizer trees and an enabling environment, both at policy and market levels, are key to success.
ICRAF focuses on the densely populated and often degraded highlands of Eastern and Central Africa and the Lake Victoria Basin, the locus of the greatest concentration of rural poverty on the continent. In western Kenya we facilitate a network of 107 organizations that seek to scale up agroforestry and sustainable agriculture: the Consortium for Scaling up Options for Increasing Farm Productivity in Western Kenya (COSOFAP).

We host the Trees on Farm Network of the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) – a vehicle to generate and promote the utilization of demand-driven Agroforestry technologies and innovations. The African Highlands Initiative (AHI) uses an integrated approach to improve livelihoods in the highlands of East and Central Africa through better natural resource management.

The South Asia region is ICRAF’s newest regional programme. The opening of a regional office in India in 2003 formalized our presence. The regional programme has identified opportunities for research and development in four eco-regions: The mountainous region of northeast India, Nepal, Bhutan and parts of Bangladesh; the Indo-Gangetic Plain of Bangladesh, India, Pakistan and Nepal; The Humid coastal areas of India, Bangladesh, the Maldives and Sri Lanka; and the Semi-arid lands of India, Sri Lanka and Pakistan.

We concentrate on improved land-use practices that integrate productive trees into agroforestry landscapes, which provide important environmental services in Southeast and East Asia. These areas are particularly well-suited to the use of agroforestry for both poverty alleviation and environmental conservation. We coordinate the Rewarding Upland Poor for Environmental Services (RUPES) network that seeks to reward upland farmers by investigating the nature of their environmental services and developing bases to recognize property rights and transfer of benefits. Our programmes span from the island nations of Indonesia and the Philippines, to the montane Southeastern Asian mainland including Thailand, Laos and Vietnam and the critical watersheds of southwestern China.