World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

WORLD AGROFORESTRY CENTRE

Annual Report 2010-2011

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

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

Our Values We strongly adhere to shared core values that guide our work and relationships with colleagues and partners:

- Professionalism
- Mutual respect
- Creativity

Our Focus We pay particular emphasis to four areas in our work:

- Accelerating impact
- Enhancing science quality
- Strengthening partnerships
- Improving operational efficiency

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Message from the Chair

The future for agroforestry has never been brighter. Growing trees in agricultural landscapes can help to improve food security, tackle environmental degradation, provide a source of cheap soil fertility and sequester carbon. In short, agroforestry has an important role to play in tackling some of the great challenges we face, from rising oil prices to the latest food crises and climate change. This makes the work of the World Agroforestry Centre more relevant than ever before.

In terms of the Centre's institutional health, 2010 was an exceptionally good year. The Centre's liquidity was further strengthened, and our ability to weather future financial uncertainty was substantially improved. In terms of all of the key financial indicators that are tracked by the CGIAR, our situation is among the strongest in the Consortium.This is not to deny that there is still considerable uncertainty about the future financing of our operations. On one hand, sluggish economic growth during the past year has caused donors to be hesitant in their commitments. On the other, it remains unclear how the CGIAR Research Programmes (CRPs) – these are at the heart of a new business model adopted by CGIAR – will be funded. The Centre is participating in seven out of fifteen of them.

In April 2011, the Board of Trustees appointed a new Director General to replace Dennis Garrity. The week-long process was thorough and democratic with prospective candidates, chosen from over 300 applicants, making their case not just to the Board but to focus groups of staff.

I would like to express the Board's deep gratitude to Dennis, who has been an outstanding director general. When he assumed the position, 10 years ago, he was given the thankless task of shedding some 20 scientific positions. In contrast, the new Director General is taking over an institution which is expanding its scientific staff and global research activities. Much of the credit for this must go to

Dennis, who is brilliant at mobilizing resources as well as a fine leader of research.

There is not enough space here to list all his achievements, but among those which immediately spring to mind are the following: he established a vibrant new regional office for South Asia and expanded our activities in Latin America; he organized two highly successful world agroforestry congresses in 2004 and 2009; and he helped to develop a new strategy which created a system of global research programmes that are now proving a good fit for the CGIAR's new research structure.

Dennis will be remembered as the father of Evergreen Agriculture, a system of tree-based land use that he has promoted tirelessly during recent years. In recognition of its importance, the Board has awarded Dennis a 15-month sabbatical to continue researching and promoting this important form of agroforestry.

We have every confidence that his successor, Tony Simons, will rise to the many challenges the World Agroforestry Centre will face over the coming years. An outstanding scientist, and someone familiar with the culture and ethos of the Centre, his appointment has been widely welcomed both within and beyond our walls. It is now up to him to appoint a new senior leadership team, including a new Deputy Director General of Research and Director of Administration, appointments which the Board will need to approve. During the past year, three of the four Africa-based CGIAR centres have appointed new Directors General, and this opens the opportunity for renewed and better collaboration in the future.

Eric Tollens
Chair of the Board of Trustees

Message from the DG

Wicked Challenges Today. Wicked Solutions Tomorrow.

Hit me again. It's so hard to believe. Could it really have been 10 years?

It was a whirlwind of a decade, being at the helm of the world's premier scientific institution that investigates the role of working trees for farmlands across the globe. But it's been a sheer joy serving with such a fantastic community of people, and a priceless personal fulfillment. But, curiously, I find myself having little interest in dwelling on the past while the imperatives of the present and future seem so stark.

The World Agroforestry Centre has an enormous responsibility in today's tumultuous world. It was created to "open a new front…on the war against hunger, inadequate shelter, and environmental degradation" and to "administer a comprehensive programme leading to better land use in the tropics". The Centre has now developed into a major force to achieve these goals. Agroforestry is currently practiced throughout the world, but more importantly, I believe it will be the basis for the farming systems of the future in the majority of agricultural ecosystems. Why is that?

It's because the agriculture of the late 21st century will have to look very different from what we see today. So different, in fact, that few people are inclined to even imagine how radically reinvented it will have to be. But if we look seriously at the truly wicked challenges that agriculture and natural resource management are facing, in both the short and long term, and we pause to appreciate the inadequacy of our conventional models to cope with them, we can begin to understand why.

Take the nexus of climate change, food security, and the deteriorating agricultural resource base. The imperative is to increase smallholder farm income and to double food production in the face of climate change, while reducing greenhouse gas emissions and reversing land degradation. Realistically, there are very few conventional agricultural options that meet all these imperatives. Agroforestry systems, however, are elegantly suited to do so.

And this report illustrates the great body of innovative research that characterizes how we are achieving tangible outcomes for smallholders in all of these areas.

In the wetter tropical environments, diversified tree-crop systems are the appropriate agricultural option for the biophysical and economic environment. And tree crop systems continue to expand throughout the humid tropics. This annual report reviews a range

of the World Agroforestry Centre's critical work that is impacting on some of the world's most important smallholder tree crop systems, including cocoa, coffee, rubber, fruits and medicinals. These diversified tree crop systems are evolving as profitable development pathways that increase productivity while providing sustained environmental services. See articles on pages 12, 16, 25, 34, 38 and 41.

But what about the conundrum of the world's extensive monoculture food crop systems? Most private and public sector agricultural research remains focused like a laser on increasing food production through conventional options, such as increasing the use of fossil fuel-based inputs, particularly fertilizers. But we know that this pathway will only further exacerbate greenhouse gas emissions. And many developing country farmers cannot afford the inputs anyway.

Double-storey tree-crop systems are a sound vision of what crop farming will be in the future. Granted, such systems are a radical departure from the conventional models. But they have already proven to have exceptional potential where they are practiced on millions of hectares in diverse environments. I'm concerned that so little attention is still given to the transformative opportunities for integrating perennials into annual crop systems. Integrating trees into agricultural systems improves the delivery of biological nitrogen, enhances internal nutrient cycling and soil water conservation, and ensures a more conducive microclimate under drought and heat stress. See article on page 30.

I see a great scientific and developmental adventure ahead: that such systems shall become the conventional practice on hundreds of millions of hectares of cereal crop fields. That vision is much closer at hand than one might think, when you examine the wicked problem in Africa of stagnant food crop yields, declining per capita food availability, and the marginalization of smallholder agriculture. Current climate variability and skyrocketing costs are major reasons why four-fifths of African farmers don't use fertilizers. However, the foundation for a transformation exists that could increase yields and crop resilience to drought, with minimal up-front investment and very low recurrent cash costs.

The evidence indicates that a double-storey evergreen agriculture of trees with crops can be based on a range of compatible tree options that increase farm productivity, enhance system resilience to climate change, and provide the global co-benefit of reversing the contributions of agriculture to carbon emissions. See article on page 40.

I believe that this evergreen agriculture allows us to glimpse a future of more environmentally sound farming where much (or most) of our annual food crop production occurs under a full canopy of trees. Double-story evergreen agriculture could be a basis for the reinvention of agriculture during the 21st century. The question is: will the CGIAR invest seriously in such radically unconventional (but farmer-proven) solutions?

As I clean out my desk these days, I find that I'm not really in much of a reflective mood. Those wicked challenges weigh heavy on my mind. But I am energized more than ever by the wicked possibilities - for the World Agroforestry Centre to contribute to re-creating the future of tropical agriculture, and indeed of the world.

Dennis Garrity
Director General

The next Director General

In April 2011, the Board of Trustees of the World Agroforestry Centre appointed Dr Tony Simons as its new Director General. Dr Simons will assume leadership of the Centre upon the retirement of Dr Dennis Garrity on 1 October 2011. Dr Garrity had served two 5-year terms as the Centre's CEO.

The announcement was made by the Board Chair Professor Eric Tollens on Friday 8 April 2011 to a gathering of staff, management and Board members at the close of the 53rd Meeting of the Centre's Board.

An intensive search process involving more than 300 applicants culminated in a week of interviews by the final shortlisted individuals during the Board Meeting. Three candidates made presentations to all staff, which were broadcast to all of the Centre's regional offices. In addition, each candidate interacted with five staff focus groups, as well as the Board. In his announcement, Professor Tollens said, "We are facing great challenges to evolve a greener, more food secure world. Tony has the vision and skills to take the Centre to even greater heights of success in achieving our mission."

"Thank you for the trust you have shown in me," Dr Simons told the staff and Board. "I am humbled, energized and motivated by this faith. With your help and support we can do wonderful things together in these exciting times of CGIAR reform." Raised in New Zealand, Dr Simons has had a long and distinguished career. He has been Deputy Director General of the Centre since 2008, and prior to that led the Centre's Trees and Markets research programme. He was appointed Honorary Professor in Tropical Forestry at the University of Copenhagen in Denmark in 2009.

Dr Simons is a graduate of the University of Cambridge, UK where he earned a PhD in Botany, focusing on tree improvement in the timber species *Pinus caribaea*. Later he worked on intraspecific variation in *Gliricidia* spp. and the reproductive ecology of Amazonian trees. He is a board member of the Danone Livelihood Fund, Plant Resources of Tropical Africa and the African Centre for Technology Studies.

Dr Simons has played a major role in implementing the strategy of the Centre, and positioning

it effectively during the reorganization of the Consultative Group of International Agricultural Research. He will be steering the Centre through this transition period, and will play a vital role in setting the agenda for how agroforestry research in the developing world generates more impact in the coming decades.

The outgoing Director General, Dr Dennis Garrity, commented, “I am delighted. Tony is superbly qualified for the position. We have full confidence in his abilities to lead the Centre forward with great creative energy.”

Achievements in research

> **I believe that the next generation of medicines should come from Africa, which is why the domestication of these species is so important.**

Trees of life

"When I get malaria, I don't go to the chemist," says Najma Dharani, a botanist at the World Agroforestry Centre and Nairobi's Kenyatta University. "I take a concoction made from *Zanthoxylum* bark, and it always works well."

Dharani is the lead author of *Common Antimalarial Trees and Shrubs in East Africa,* which describes the findings of a research project involving the World Agroforestry Centre, the Kenya Medical Research Institute and traditional medical practitioners. The book focuses on the ecology, use and active ingredients of 22 plants used in the treatment of malaria. "Pastoralists like those in Turkana and Samburu have been using indigenous plants as medicines for hundreds of years, and they continue to do so," says Dharani. This is partly because they have no choice; few have access to clinics and modern medicines.

Caused by the *Plasmodium* parasite, malaria has a devastating impact on communities throughout sub-Saharan Africa. It is the leading cause of death in children under five, and of the infectious diseases in Africa only HIV/AIDS kills more people. It is estimated that just 8% of children under five with malaria in Kenya in 2007 were treated with modern artemisinin-based combination therapies. This is one reason why traditional remedies are so important.

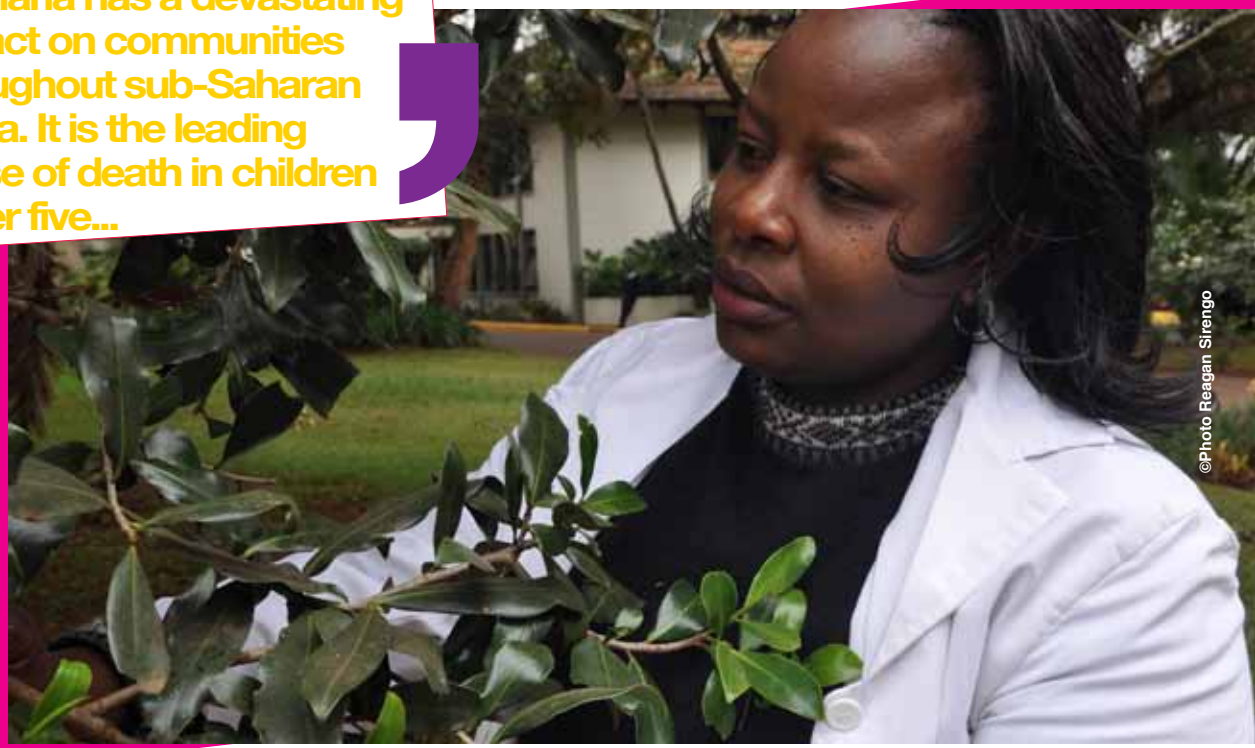
The book is aimed at two distinct audiences. It informs scientists about key gaps in research. To give just one example, *Zanthoxylum* species contain substances that are reported to show strong anti-malarial activity. According to Dharani, they also have the potential to treat other diseases, yet relatively little research has been done on this group of trees.

The book also provides guidance to local communities. "We found that some people are using species to cure malaria which don't show strong anti-plasmodial activity, so we recommend that they use those species which do."

Dharani and her colleagues are training local communities how to establish nurseries and encouraging them to plant antimalarial trees on their farmland. "I believe that the next generation of medicines should come from Africa, which is why the domestication of these species is so important," she says. The *Lancet*, one of the world's leading medical journals, was one of many publications to run features about the book.

Dharani N, Rukunga G, Yenesew A, Mbora A, Mwaura L, Dawson I and Jamnadass R. 2010. *Common antimalarial trees and shrubs in East Africa.* Nairobi: World Agroforestry Centre.

...malaria has a devastating impact on communities throughout sub-Saharan Africa. It is the leading cause of death in children under five...



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> In sub-Saharan Africa, women contribute 60–80% of the labour involved in producing food for household consumption and for sale.

Women in sub-Saharan Africa often not rewarded for their work

In sub-Saharan Africa, women contribute 60–80% of the labour involved in producing food for household consumption and for sale. They also play a major role in promoting agroforestry practices. Yet a review by the World Agroforestry Centre reveals that men often receive greater benefits from the endeavours of women than the women themselves.

The review, based on 104 studies, found that women's participation in harvesting and processing indigenous fruits and vegetables is much higher than that of men. However, the latter dominate the wholesale trade and take the larger share of the profits.

Women in female-headed households are as actively involved as men in the production of fodder shrubs and woodlots, and in the use of agroforestry techniques that improve soil fertility. However, the area of fodder shrubs and the number of trees grown by female-headed households is approximately half that grown by male-headed households. This is due, in part, to women's lack of resources, particularly land and labour, and perhaps also their greater aversion to risk.

Women in male-headed households tend to do most of the work, such as planting, weeding and watering, especially during the early stages of tree establishment.

"However, when it comes to harvesting, women's rights are confined to collecting by-products such as twigs, whereas men have the rights to timber, large branches and poles," says Evelyne Kiptot, co-author of an Occasional Paper on *Gender and Agroforestry in Africa: Are Women Participating?*

A variety of social, cultural and economic factors put women at a disadvantage. "In most parts of Africa, men own the land and the tree crops grown on the land, even if women have planted and managed them," says Kiptot. Women also have less access to credit than men and benefit less from agricultural extension services.

Kiptot and her co-author, Steven Franzel, suggest a number of measures to improve women's status. Targeting women's groups is an important way to increase benefits for women. Increasing the number of female extension agents is another. On a practical level, promoting participatory domestication of indigenous fruit trees, and the development of appropriate storage and processing methods for ripened fruit, could help to increase cash flow, especially for women. They also suggest that policymakers should ensure that women have better access to extension services, market information and credit. If that happened, they would derive greater benefits from agroforestry.

Kiptop E and Franzel S. 2011. *Gender and agroforestry in Africa: are women participating?* Occasional Paper No.13. Nairobi: World Agroforestry Centre.

Kiptot E and Franzel S. 2011. Gender and agroforestry in Africa: a review of women's participation. *Agroforestry Systems* DOI 10.1007/s10457-011-9419- y

> In some countries, production could shift to areas where there is greater winter chill, but this could be prohibitively expensive.

©Photo World Agroforestry Centre archives

Global warming could affect fruit and nut yield

Warmer winters could have a significant – and in some places, disastrous – impact on the global fruit and nut industry, which is worth over US$90 billion a year. Research by World Agroforestry Centre scientist Eike Luedeling identifies future trouble spots.

Luedeling got a glimpse of how the future could look for many farmers growing temperate fruits and nuts when he visited North Vietnam in 2010. “There were some 10-year-old plum trees that looked as though they were 100 years old,” he recalls. “Some had flowers as well as fruit. They were clearly confused and experiencing inadequate levels of winter chill.”

Like other temperate fruit trees, plum trees protect themselves in winter by shedding their leaves and sensitive tissue and becoming dormant. Each species needs a certain amount of chilling to break the dormancy and spring into leaf again. When the chilling requirement is not fully met – as was the case in the orchard Luedeling saw in Vietnam – the trees suffer from reduced or delayed flowering, strange growth forms and low yields. That is why fruit farmers in major growing regions choose species and cultivars adapted to local winter chill.

Drawing on data from over 4000 weather stations, Luedeling and his colleagues estimated winter chill for two past and 18 future scenarios, using three different global climate models and three greenhouse gas emissions scenarios. From these, they estimated the amount of winter chill that will be exceeded in 9% of all years. “We chose this figure because it makes sense for

fruit and nut producers," says Luedeling. "If they don't get the required chilling requirements for more than 10% of the years, their operations will become unprofitable."

The projections suggest that warm regions will experience the greatest declines in winter chill over the next century. Cooler regions, in contrast, will see little change. This is disturbing news for fruit and nut growers in California's Sacramento Valley, China's Yunnan Province, parts of Australia and several other major growing areas. Already, fruit growers in North Africa are experiencing declining yields as a result of the reduced winter chill; matters are likely to get worse in the future.

So what is the solution? In some countries, production could shift to areas where there is greater winter chill, but this could be prohibitively expensive. A more viable approach hinges on the development of new cultivars that become more productive under lower chill conditions. This has already been achieved for peach trees in Florida. Much more work needs to be done to develop suitable cultivars for a whole range of species, says Luedeling. "One thing that is clear from our research is that choosing the same cultivars that your grandfather planted may not be a good idea."

Luedeling E, Girvetz EH, Semenov MA and Brown PH. Climate Change Affects Winter Chill for Temperate Fruit and Nut Trees. http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020155

> We also found that the grasslands were not adapting as quickly to climate change as one would expect.

Out of steppe

Most studies that have investigated the impact of climate change on grassland areas have found that spring comes earlier as temperatures rise, and autumn begins later. However, this was not what Jianchu Xu, the World Agroforestry Centre's coordinator for China, and his research colleague, Haiying Yu, found when they looked at the onset of spring growth on the Tibetan plateau, using remote sensing data from 1982 to 2006.

As the annual temperatures steadily rose, the date at which the grass began to grow shifted from early June to late May just as you would expect. But all of a sudden, in the late 1990s, the trend was reversed: the growing season began later as the years passed, even though the average temperatures continued to rise. Jianchu and Haiyang shared their findings with Eike Luedeling, who had been researching the influence of winter chill on temperate fruits and nuts (see story on page 16).

"The more we looked into it, the more likely it seemed that reduced winter chill was at work," says Luedeling. The steppe vegetation on the Tibetan plateau is extremely sensitive to temperature change, and the declining winter chill factor meant that the grasses were taking longer to break their winter dormancy. "We also found that the grasslands were not adapting as quickly to climate change as one would expect," he says. Grass species that are better adapted to a warmer climate have yet to move on to the steppes. This may be because most propagate vegetatively rather than by seed. Whatever the reason, the growing season is becoming shorter, which is bad news for Tibet's pastoralists.

Yu H, Luedeling E and Xu J. 2010. Winter and spring warming result in delayed spring phenology on the Tibetan plateau. Proceedings of the National Academy of Sciences of the United States of America, 107 (51). doi: 10.1073/pnas.1012490107.

© Photo Walter van Dijzeeland

> ..development agencies and governments need to think carefully about who to target when promoting agroforestry as an activity that reduces vulnerability to climate change.

Farmers' views on climate change

When Harvard graduate Tannis Thorlakson explored the contribution that agroforestry could make to reducing subsistence farmers' vulnerability to climate change in Western Kenya, she canvassed the views of the people who really mattered: the farmers themselves.

Thorlakson conducted a series of household surveys, in-depth interviews and group discussions in Nyando District, where there are high levels of poverty. During the previous year, the district had experienced both droughts and floods, and Thorlakson was able to gauge the impact these had on farmers' livelihoods and practices. Many families had suffered, with the disastrous weather conditions forcing them to sell agricultural tools, consume seeds which should have been used for planting, and make other sacrifices. Climate change could make their lives even more difficult in future.

Most of the farmers believed the best way of coping with climate threats and stresses involved improving their standard of living. Agroforestry helps farmers do this by raising productivity and incomes though diversification, and providing farmland with greater resilience to climatic hazards. However, agroforestry is a long-term process, and farmers have to wait some years before they experience tangible benefits. This helps to explain why the poorest farmers did not invest much in planting trees, despite their evident benefits; they could not afford to think about the future.

"Thorlakson's research contains a very important message for development agencies," says Henry Neufeldt, head of climate change research at the World Agroforestry Centre. "It shows that if farmers can't afford to forego the income they earn from annual crops – and that's the case for the poorest farmers – then they won't be able to invest in agroforestry or other climate-smart activities which could help them break out of the poverty trap." This means that development agencies and governments need to think carefully about who to target when promoting agroforestry as an activity that reduces vulnerability to climate change.

Thorlakson T. (forthcoming). Reducing subsistence farmers' vulnerability to climate change: the potential contributions of agroforestry in Western Kenya. Nairobi: World Agroforestry Centre.

> We've developed these at resolutions that will enable extension agencies and others to approach individual farmers and discuss interventions to improve soil condition.

©Photo World Agroforestry Centre archives

Positive impact of soil information service

Soil degradation in Africa is so widespread that millions of farming families struggle to feed themselves – cereal yields have barely risen over the past 30 years – let alone produce a surplus to sell. Restoring the health of Africa's soils is vital to tackling poverty which is why the African Soil Information Service (AfSIS) is so important.

Launched in 2009 with funding from the Bill and Melinda Gates Foundation and the Alliance for a Green Revolution in Africa (AGRA), the four-year project is conducting a systematic evaluation of soil health at 60 sites in 21 countries. "By the time the first phase of the project comes to an end, we will have produced a first-cut map for the whole of sub-Saharan Africa," says World Agroforestry Centre soil scientist Keith Shepherd. This will provide a far more detailed evaluation of soil health than any previous studies.

An external review, conducted at the halfway stage of the project, described AfSIS as a 'unique scientific effort.' It praised the outstanding design and implementation of the project, its ground-breaking use of infrared spectroscopy to assess soil health and the extensive training of national scientists.

"During the past year, we have devoted considerable effort to managing a rapidly expanding database, demonstrating the validity of the methods used to gather information and packaging information in different ways to satisfy a range of users," says Shepherd.

The project has produced reports on soil properties for each of the sites sampled. These provide feedback for extension agencies and agronomists on the main constraints to plant growth, with detailed information on salinity, pH and deficiencies in minerals such as phosphorus, potassium, manganese and zinc. This is just the sort of information required by individuals and organizations who wish to improve soil health and productivity.

During the past year, Tor-Gunnar Vågen, the principal investigator for the soil and ecosystem health component of AfSIS, has been working with his colleagues to create indices of soil condition. “We’ve developed these at resolutions that will enable extension agencies and others to approach individual farmers and discuss interventions to improve soil condition,” he says. Data generated by AfSIS will also provide national authorities with the information they need to design soil rehabilitation strategies and identify areas of particular risk of degradation.

During 2010, AfSIS researchers developed a methodology for measuring soil carbon stocks, using data gathered both within and beyond the 60 sites. Baseline carbon studies could be particularly useful for organizations that wish to enter the carbon market, or track changes over time. One study, carried out for the Kenyan Forestry Research Institute and the Kenya Wildlife Service, is mapping soil carbon stocks in and around Mount Kenya. Others were commissioned by the East Africa Dairy Development Project and by a private organization managing rangelands in Laikipia, Kenya.

One of the key recommendations made by the project review was that AfSIS should become a demand-driven service-provider with a business mindset. “Over the next year, we will be devoting more time to working out how to get commercial soil-testing laboratories and others interested in using the information and tools we’ve developed,” says Shepherd.

It’s tough out there

“Much of the historic data we have for soils in Africa is clustered around research stations,” says Tor-Gunnar Vågen, principal investigator for the AfSIS project. The data also tends to be very broad; soil maps generated in the 1960s and 1970s, many still in use, failed to take into account the huge local variability of soil properties.

Rather than sampling where it is convenient, AfSIS has used a system of random sampling, based on probability theory. Samples have been taken, or will be taken, in 60 sentinel sites, each 10km by 10km. During 2010, AfSIS field teams completed sampling at 22 sites. Within each site, there is a hierarchy of randomized sites, at which the field teams take soil samples and record data on erosion risk, vegetation density, land-use and other factors. Soil samples are analysed in regional laboratories in Mali, Malawi and Kenya using infrared spectroscopy. Subsamples are sent on to Nairobi for more sophisticated analysis, for example using laser and x-ray equipment.

This may sound straightforward on paper, but the logistical challenges have been considerable. “In some countries, the field teams haven’t been able to conduct surveys because of the security situation, and in others, it’s been difficult or impossible to get the necessary permits to operate inside protected areas,” says Vågen. Add to this the challenges of crossing borders, covering huge distances and working in some of the most hostile environments in Africa, from dense tropical forests to remote areas of semi-desert, and you begin to get the picture. Nevertheless, the field teams are on target to complete the surveys of sentinel sites by 2012. “In fact, we might even manage to do a few extra,” says Vågen.

> One thing which surprised us was how little guidance there is about how to establish carbon projects for the voluntary market.

©Photo Michael Goldwater/Gender and Diversity Program

Paying for environmental services needs better guidelines

Over the past decade, schemes that involve payments or rewards for environmental services have become increasingly popular. The idea is simple enough: in return for providing a range of environmental services, such as conserving landscapes, protecting watersheds or sequestering carbon, farmers and other land uses are rewarded through payments in cash or in kind. But how much do we know about the way these projects work, and what needs to be done to make them a success? Not as much as we should is the short answer.

In 2010, World Agroforestry Centre scientist Henry Neufeldt and Caitlin Patterson conducted an internet survey to explore the experiences of Rewards for Environmental Services (RES) schemes across the globe. They analysed responses to 17 questions relating to 55 different projects, covering a wide range of environmental services (carbon, biodiversity, water) in Africa, Asia, Latin America, North America, Europe and Australia. They ranged from small projects with less than 1000 participants to large ones with over 10 000 participants. At the time of the project survey, 21 of the 55 projects were fully functional.

The survey found that project developers favoured partners with clear rights of tenure. The rewards offered by the projects varied from cash payments to better access to markets and the distribution of agroforestry materials such as seedlings. The majority of respondents believed their projects were helping to alleviate poverty. However, the requirement for clear tenure may exclude the poorest members of society from participating in these sorts of projects.

The survey revealed that there is very little structured sharing of information about what makes projects successful, or otherwise. “One thing which surprised us

was how little guidance there is about how to establish carbon projects for the voluntary market," says Neufeldt. "There is clearly a need for a step-by-step manual which takes project developers and potential sellers through the whole process from setting up schemes to accessing the market." The issue is not so much about a lack of information, he says, but how to find the right information.

The survey revealed that existing uncertainty about the carbon market has had a negative impact on the ability of projects to secure funds. If this uncertainty continues then investors will become increasingly wary of participating in carbon markets. However, if there is a global agreement on promoting projects that reduce emissions from deforestation and degradation (REDD), tradable bio-carbon would experience a significant increase in demand.

Neufeldt and Patterson also analysed their results using the three paradigms developed by World Agroforestry chief scientist Meine van Noordwijk and a research colleague to describe and distinguish between different sorts of reward schemes (See box). Neufeldt and Patterson found that the majority of projects in their internet survey defied classification under one specific paradigm, reflecting the variability in many project traits.

A new classification system?

The most commonly used definition of payments for environmental services was devised by Sven Wunder of the Center for International Forestry Research (CIFOR): the payments are voluntary transactions where a well-defined environmental service is bought by a minimum of one buyer from a minimum of one provider. For example, a utility company might pay land users to plant trees and sequester carbon, thus helping it to offset its emissions.

World Agroforestry Centre scientist Meine van Noordwijk and Beria Leimona of Wageningen University believe this definition is too narrowly focused on market-based mechanisms for enhancing environmental services. In a paper published in *Ecology and Society*, they argue that reward systems should be analysed on the basis of how they meet four conditions: they should be realistic, conditional, voluntary and pro-poor.

Based on research conducted in Asia, the authors defined three ways of analysing compensation and reward schemes: commoditized environmental services (CES); compensating for opportunities skipped (COS); and co-investment in stewardship (CIS). The first focuses on the direct interaction between the community that provides the environmental services and the beneficiaries. The second rewards land users for accepting restrictions on the way they use their land. The last relates to activities on collectively owned or state-owned land.

According to van Noordwijk and Leimona, the CIS approaches have the greatest opportunity to be pro-poor, as the other two presuppose property rights that the rural poor often do not have. "CIS requires and reinforces trust building after initial conflicts over the consequences of resource use have been clarified and a realistic appraisal is obtained," says van Noordwijk.

Van Noordwijk M and Leimona B. 2010. Principles of fairness and efficiency in enhancing environmental services in Asia: payments, compensation, or coinvestment? *Ecology and Society* 15 (4).

> **The World Agroforestry Centre's dissemination methods in local languages were highly effective.**

Shaping the future of rubber agroforestry

The World Agroforestry Centre launched its research on rubber agroforestry in Indonesia in the mid-1990s. By then, many development agencies had already spent millions of dollars promoting high-yielding monoclonal rubber plantations, and these were beginning to replace traditional jungle rubber systems on many smallholdings.

"The monoclonal plantations gave farmers much higher yields than jungle rubber gardens, and therefore better incomes," says World Agroforestry Centre economist Suseno Budidarsono. "But there were also some disadvantages." They required considerable capital investment, which many households could not afford. The conversion of jungle rubber to monoclonal rubber systems was also causing significant losses of biodiversity.

These trends, and the conversion of jungle rubber to oil palm, prompted the Centre and its partners to devise alternative systems of rubber agroforestry that would improve smallholder yields while retaining some biodiversity. The story of this research, spanning over a decade and a half, is told in a booklet in the 'Trees for Change' series. Among other things, this publication highlights the Centre's success in encouraging farmers to adopt its rubber agroforestry systems.

In 2010, researchers compared rates of adoption in 30 villages in Sanggau District, West Kalimantan, and 30 villages in Bungo District, Jambi. In villages where the project had been active, the area and number of households adopting the new systems increased tenfold. More surprisingly, rates of adoption in villages where the project had not been active were almost as high.

The researchers identified several reasons for this. First, smallholders in Indonesia had heard of clonal rubber varieties and their advantages, and many had tried them – not always with success – in the past. This meant that it did not require a huge effort to promote new clones. Second, the World Agroforestry Centre had been a key source of information about clones for farmers who were not associated with its present or past projects. This suggests that its dissemination methods in local languages were highly effective. Finally, the government and development agencies had actively promoted the use of new clones.

Pye-Smith C. 2011. *Rich Rewards for Rubber Agroforestry?* Trees for Change No 8. Nairobi: World Agroforestry Centre.

> You only had to look at the coffee under shade to see it was in better condition.

©Photo World Agroforestry Centre archives

Coffee – with or without?

A major research programme: Connecting, enhancing and sustaining environmental services and market values of coffee agroforestry in Central America, East Africa and India (CAFNET), came to an end in 2011. Research in Rwanda has provided vivid proof of the virtues of growing trees on smallholder coffee gardens. This was just one of many CAFNET projects.

"During the 1960s and 1970s, coffee growing experienced its own green revolution," explains Fabrice Pinard, a coffee scientist seconded to the World Agroforestry Centre by the Centre de Coopération Internationale en Recherche Agronomique pour le Développement in France. Many growers and companies abandoned traditional methods of growing coffee under shade and began to plant coffee in rows under full sun. These intensive systems of production required the use of large quantities of fertilizers, pesticides and water, and they worked well in Brazil, Colombia and various other parts of the tropics.

Little wonder, then, that many governments encouraged smallholders to adopt similar systems. However, the results have often been pitiful. "Many smallholders can't afford to buy fertilizers or irrigate their coffee, and they're getting a fifth or less of the yield that they would be getting if they could afford the inputs needed to sustain full-sun coffee," says Pinard.

The plight of these farmers encouraged CAFNET to examine the influence of shade on coffee production.

The project focused on 50 smallholdings in Kivu, Rwanda. At each, the researchers studied the performance of four randomly chosen coffee bushes under shade and four growing in full sun.

Under shade, the mean harvest of coffee cherries over the 3-year research period was 9.6 kg per bush, compared to 7.1 kg in full sun. The production of green coffee was also higher under shade. "You only had to look at the coffee under shade to see it was in better condition," says Pinard. "The leaves were greener and more plentiful." He believes this is because cultivated coffee, whose ancestors come from the forests of Ethiopia and the Congo Basin, is adapted to shade conditions. It only performs well in full sunlight when it has a plentiful supply of fertilizer and water.

But why hadn't farmers planted more trees if it was so obvious that shade was beneficial? The answer is partly political. When the governments in Rwanda and Kenya first began to promote intensive systems of production, farmers were forbidden from planting trees in their coffee gardens. Fortunately, the extension services now recognize the virtues of providing shade and they are promoting tree-planting.

"Our research provides clear evidence to support this policy," says Pinard. It also provides guidance about which species of tree work best. Leguminous trees, such as *Acacia* and *Albizia* species, help to improve soil fertility, while avocado (*Persea americana*) and a local fig, *Ficus thonningii*, seem to stimulate coffee production.

©Photo Tito Marcos

Linking Peru's cocoa producers to organic markets

Peru's cocoa exports have increased dramatically over the past few decades, and the country is now the second-largest producer of organic cocoa in the world. Some of the finest 'aroma' cocoa is grown by the 120 members of the Association of Cocoa Producers from Padre Abad (ACATPA), based in the Ucayali region.

Since the association was formed in 2000, it has benefited from a range of projects that have enabled members to significantly improve the management of their cocoa gardens and increase their yields. The World Agroforestry Centre has been an influential supporter, and members of the association now plant their cocoa as part of an agroforestry system.

In February 2011, the World Agroforestry Centre and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the German development agency, provided support for members of ACATPA to visit BioFach, the world's largest organic products fair, held in Nuremberg, Germany. Led by Daniela Hirsch, the association's organic certification adviser, the cocoa farmers met importers, manufacturers and others involved in the organic cocoa trade. This helped them to gain a thorough understanding of the market and its requirements. After the fair, the delegation was invited to visit the Austrian headquarters of Zotter, a company renowned for its 'fair trade' organic chocolate.

REALU progress in Peru

Saving existing forests, or planting new ones, is one way of tackling global warming. This idea underpins all the discussions, and projects, related to Reducing Emissions from Deforestation and Forest Degradation (REDD). However, scientists from the World Agroforestry Centre have argued that REDD projects frequently do not go far enough, as significant forest-related carbon emissions occur outside areas designated as forests. Hence the concept of REALU – Reducing Emissions from All Land Uses.

Last year's annual report described work in Peru under the first phase of the REALU project. Since then, under the second phase, there has been significant progress in analysing the potential of REALU for some of the heavily deforested regions of the country.

During the early months of 2011, Peru's REALU team of scientists participated in a series of meetings in Ucayali region. The first, attended by 45 people from 20 different institutions, analysed all the REDD-related activities currently being undertaken in Peru and helped to clarify the precise meaning of REDD and its variations – an essential step if confusion over terminology is to be avoided.

The second meeting helped to design the REDD group's objectives for Ucayali region. It was agreed that there should be a strong emphasis on collaborative research, with a focus on assessing threats to the forests, the opportunity costs of conserving forests and the measurement of carbon stocks. The Centre's scientists also played a prominent role in a national workshop on REDD.

Research was high on the agenda this year, with Centre scientists conducting a range of activities related to REDD and REALU. These included research on methodologies for using remote sensing to create atmospherically corrected cloud-free satellite images and the updating of data on land cover and vegetation maps. Researchers also began to measure the carbon stocks of peatlands – *aguajales* – under a collaborative agreement with the Peruvian Amazon Research Institute.

©Screen shot Useful Tree Species for Africa tool

> **Over much of Africa, farmers are planting tree seeds which aren't adapted to their land and climate.**

Mapping a better future

A great store of information, drawn up by botanists working for the colonial authorities in Africa in the early 20th century, has been rescued from the archives, digitized and reinterpreted to provide farmers, non-governmental organizations (NGOs) and others with the guidance they need to plant the right trees in the right places.

Let's say you want to rehabilitate an area of degraded land in Africa or plant large numbers of fruit or timber trees. Where do you get information about which species to plant and where to get seeds and seedlings? The chances are you will have to rely on the knowledge of local organizations, nurseries or government extension staff. All too often, the advice will focus on a few favourite species which are not adapted to the local situation.

"Over much of Africa, farmers are planting tree seeds which aren't adapted to their land and climate," explains Jens-Peter Lillesø, a scientist with Forest and Landscape Denmark. He gives the example of *Prunus africana*, whose bark has important medicinal properties. Like many tree species, it consists of a large number of distinct populations, each of which is adapted to a particular set of ecological conditions. "You can't just collect seed from one place and expect to use it successfully in another," he says, "but that's what happens for most agroforestry species in Africa."

The Vegetation and Climate Change in East Africa (VECEA) project, described in our 2009-2010 annual report, has helped to provide a remedy in seven countries stretching from Ethiopia in the north to Zambia in the south. The vegetation maps produced by the project provide NGOs, farmers and tree seed centres with the information they need when choosing which trees to plant and where to source their seeds and seedlings. The project has also predicted which species will grow well, and where, under different climatic conditions.

During the past year, Roeland Kindt, an ecologist at the World Agroforestry Centre and collaborator in VECEA, conducted a parallel exercise to turn a vegetation map for the whole of Africa into a tree selection tool. The Useful Tree Species for Africa tool was funded by the United Nations Environment Programme and the Global Environment Fund as part of the Carbon Benefits Project. Kindt and his colleagues modified vegetation maps drawn up in 1983 by Frank White, an English botanist. These were based on maps made by botanists in earlier decades.

"We have turned White's map into a tool for selecting useful species, using an overlay on Google Earth," says Kindt. "It is interactive and easy to use. You click on the location you're interested in, and it provides information about the vegetation type, with links to species composition tables." Users can also select a subset of species to provide desired end-products or environmental services, and there are links to detailed descriptions of each tree species.

Inevitably, the resolution for the map of Africa – White used the scale of one to 5 000 000 – is lower than that used for the VECEA project. "Eventually, we would like to produce a map for the entire African continent which provides similar levels of detail and accuracy as VECEA," says Lilleso. "Nevertheless, the maps are still accurate enough to provide users with the sort of information they need to decide which agroforestry species will grow best in particular areas, and where to get their seeds and seedlings."

[1] Link: http://www.sl.life.ku.dk/English/outreach_publications/computerbased_tools/vegetation_climate_change_eastern_africa.aspx

[2] Link: http://www.worldagroforestrycentre.org/our_products/databases/useful-tree-species-africa

> This knowledge is essential if we are to conserve and sustainably manage forests across the globe.

©Photo World Agroforestry Centre archives

So what have we got?

A major project is underway to document the state of the world's forest genetic resources. Coordinated by the United Nations Food and Agriculture Organization (FAO), it will provide information vital for the conservation and use of tree species that provide millions of people with food, timber, medicines and fodder.

FAO has already produced 'State of the World' reports on plant and animal genetic resources, with a focus on agricultural crops and livestock. In 2007 the FAO Commission on Genetic Resources for Food and Agriculture decided to produce a report on trees. In April 2011, the World Agroforestry Centre hosted a workshop in Nairobi, in collaboration with FAO and Bioversity International, which provided guidance to experts from 33 African nations on how to collect and collate information. The country reports from individual African countries will be combined with those from nations elsewhere to produce a global synthesis.

The fact that we do not know precisely how many tree species there are in the world – estimates range up to 100 000 – says much about our imperfect knowledge. "We could lose a lot of species, and forest genetic diversity, before we even know precisely what we've got, including species and provenances that could provide valuable goods and services," says Lars Graudal, Director of Research at Forest and Landscape Denmark (FLD), one of the organizations contributing to the new report. "That's why it is so important to document the state of these resources now."

Deforestation and over-exploitation are already threatening the genetic diversity of many species. In East Africa, to give just one example, there are at least 30 tree species which are known to have anti-malarial properties (see story on page 12). As forest land has been converted to other uses, and harvesting pressures have risen, some of these species have become rarer, with serious implications for the health care of rural communities that do not have access to, or cannot afford, modern medicines.

Ian Dawson, a World Agroforestry Centre consultant geneticist who helped to organize the workshop, estimates that most African countries will identify 30 to 40 tree species that are important to forest harvesters, smallholders who practice agroforestry and local communities. "I also anticipate that some countries will identify endemic species that do not have particular human uses at present, but may be important for conservation because of their ecosystem functions or, simply, their rarity," he says.

The State of the World report, due to be published in 2013, will provide an insight into the threats and possible development potential of hundreds of tree species. It will help policymakers and scientists identify gaps in knowledge and formulate action plans to conserve and use important tree genetic resources. As Oudara Souvannavong, a senior forestry officer at FAO, told participants at the workshop: "This knowledge is essential if we are to conserve and sustainably manage forests across the globe."

©Photo Valter Zlantoni

> **Our research shows that it's critically important to support local communities, involve them in decision-making and provide them with the skills needed to restore degraded land.**

Tackling land degradation in India

It is estimated that 6% of India suffers from some form of land degradation, with Rajasthan being one of the worst affected states. "In some areas, overgrazing has been so severe that trees have been reduced to knee-high stumps," says Pal Singh, the World Agroforestry Centre's regional coordinator for South Asia. A shortage of livestock fodder and declining crop yields have forced many families to migrate to the cities in search of work.

Recent research suggests that community-driven restoration schemes can play an important role in tackling land degradation across India. As evidence, Pal Singh cites the success of a scheme initiated by one of the Centre's partners in Rajasthan, the Foundation for Ecological Security (FES).

A range of relatively simple soil conservation measures were introduced in two villages, Amartia and Kekadia. The communities constructed contour trenches, gully plugs, soil-filled cages, loose boulder check dams and earth bunds – these help to retain water during the rainy season – and a series of stone-wall enclosures. They also planted trees, seeded some areas with leguminous fodder crops and introduced measures to control grazing. "The soil in these areas is now much richer in nutrients and biological activity than it was in the past," says Singh. "Over the past 6 years, these measures have helped to transform the landscape."

Rainwater run-off has been reduced from 80% to 45–50% in the areas where bunds were constructed. The water level in the wells has risen by 1.5 m, and there has been a significant increase in forest cover. Before the conservation measures were introduced, farmers in the two villages were able to grow two crops a year on just 73 ha of arable land. Now, thanks to the greater availability of water and nutrients, they are double cropping 135 ha, and crop productivity has risen by 24%, reports Ravindranath of FES. Before the project began, farmers were obliged to buy livestock fodder for at least 6 months a year. Now they have a surplus, and in 2010 they raised over 1.4 million rupees (US$30 000) from fodder sales.

"Our research shows that it's critically important to support local communities, involve them in decision-making and provide them with the skills needed to restore degraded land," says Singh. Putting this principle into practice is at the heart of two other research and restoration schemes launched by the World Agroforestry Centre and its partners in India. One is helping farmers along the Brahmaputra River to restore land that has been smothered with nutrient-poor sand, the consequence of poor land management upstream. The other, in Orissa and neighbouring states, is exploring ways to help farmers restore fertility to land that has been choked by toxic mine tailings.

> Yields are higher and drought-induced crop losses dramatically lower on farms that use this slash-and-mulch system than on farms that don't.

©Photo Reagan Sirengo

Hotspots of biological activity

Trees play a major role in maintaining and improving soil fertility. Understanding how they do this, and which species affect soil in different ways, is fundamental to designing mixtures of tree species that can make farms more productive.

Soil teems with organisms, from invisible microbes that fix atmospheric nitrogen to earthworms that mix organic materials and develop and maintain soil structure. It is through the activity of a wide range of organisms that fertility is generated and maintained.

In 2011, the World Agroforestry Centre published a review of the impact trees have on soil biodiversity. Led by Edmundo Barrios, who joined the Centre as Soil and Land Management Scientist the previous year, the review shows a consistent pattern: the presence of trees is associated with a greater abundance of soil organisms across a range of sites in agroforestry systems. This is clearly shown in studies that compare the presence of soil organisms in monocrops – for example, a field of maize – with plots where crops are grown together with trees. Earthworms, centipedes and millipedes are more than three, five and six times more abundant respectively under agroforestry systems than they are in fields with annual crops without trees. Beetles, ants and mites are also more plentiful.

Before joining the Centre, Barrios had conducted extensive research on the Quesungual agroforestry system in Central America with colleagues at the International Centre for Tropical Agriculture and collaborators at the University of Western Australia and University of California-Davis. Widely practised in the drought-prone, steeply sloping uplands of western Honduras, the system involves farmers selectively pruning trees interspersed among their annual crops, leaving the green matter as a mulch that eventually decomposes and becomes incorporated into the soil.

"Yields are higher and drought-induced crop losses dramatically lower on farms that use this slash-and-mulch

system than on farms that don't," says Barrios. To avoid disruption on the farms, the scientists measured the quantity of worm casts as an index of biological activity. "We found a higher concentration of biological activity, greater amounts of carbon and nutrients, and longer availability of water in soils under the influence of trees, including slash and mulch management, than in fields without trees or soil further from trees," he says.

"We now have a working hypothesis that the perennial nature of trees has a profound impact on soil properties, and on the abundance, diversity and functions of soil organisms," says Barrios. This explains why trees increase and sustain soil fertility. Besides acting as a refuge for soil organisms, trees used in agroforestry systems can increase the supply and availability of nutrients, maintain and improve soil structure and control soil-borne pests and diseases.

"One important area for new research is to identify which tree species and mixtures of species do most to promote biological activity in the soil," explains Fergus Sinclair, who leads the Centre's research on farming systems. "A keystone of our research strategy for improving soil and water productivity is to understand how different types of trees interact with soil organisms so we can develop design principles that enable us to select appropriate mixtures of trees to sustain soil fertility for different sites and circumstances."

AfSIS, the African Soil Information Service (see page 20), is providing an opportunity for Barrios to work with scientists mapping soil health across the continent. The collection of soil biodiversity data has begun in Tanzania, at one of the 60 AfSIS 'sentinel' sites. Linkages between trees and soil fauna are being explored to identify biological indicators associated with the provision of soil-based ecosystem services. These will become part of the land health surveillance system.

Three times more earthworms are found in agroforestry systems

Barrios E, Sileshi GW, Shepherd K and Sinclair F. 2011. Agroforestry and soil health: linking trees, soil biota and ecosystem services. In: Wall DH (Ed.). The Oxford Handbook of Soil Ecology and Ecosystem Services. Oxford, UK: Oxford University Press. Chapter 5.2. (in press).

©Photo Steve Mann

Development impact

> It's a win-win situation for farmers: no loss of income, and a prolonged and more productive life for their orchards.

©Photo World Agroforestry Centre archives

The kindest of cuts

The future should be rosy for India's mango farmers. Demand for the fruit is rising not only at home, but elsewhere – for example, by around 15% per year in the United States. Indian farmers, who already account for around 40% of world production, should be ideally placed to take advantage of the expanding market. But there's a problem: over half the country's mango orchards are over 40 years old.

"These old orchards are very unproductive, and many only produce fruit intermittently," explains Pal Singh, the World Agroforestry Centre's regional coordinator for South Asia. "Farmers can uproot the trees and replace them with new saplings, but if they do that, they'll have to wait between 6 to 10 years before they get any fruit." For those with little land and capital this simply isn't an option.

Fortunately, there is an alternative. Over the past decade, the Indian Agricultural Research Institute (IARI) and the World Agroforestry Centre have conducted research on ways of rejuvenating old mango orchards. The trees are cut back to just over a metre high, leaving a few green shoots to form new branches. "With the correct procedures, in terms of pollarding, the use of fertilizers and irrigation, farmers will get their first harvest after 3 to 4 years," explains AK Singh, head of IARI's Division of Fruits and Horticultural Technology. The yields of rejuvenated orchards can reach 12 tonnes per ha per year, more than double the average for India.

Pollarding prolongs an orchard's life by up to 15 years. By reducing the canopy, it also enables farmers to plant new high-yielding varieties between the pollards. There is another advantage too. The timber harvested has a value equivalent to 4 or 5 crops of fruit. In short, it's a win-win situation for farmers: no loss of income, and a prolonged and more productive life for their orchards.

©Photo Gates Foundation

> **Agroforestry technologies are very knowledge intensive, and some farmers in the study area simply don't have the skills to adopt them, even if they want to.**

Falling by the wayside?

Agroforestry technologies can significantly improve crop yields. So why are they not more widely practised if their virtues are so obvious? Recent research in Western Kenya provides some clues.

Between 1997 and 2004 the World Agroforestry Centre, the Kenyan Forestry Research Institute (KEFRI) and the Kenya Agricultural Research Institute (KARI) introduced two agroforestry practices to improve soil fertility in 17 villages in Siaya and Vihiga districts. They did so using a low-cost extension method known as the 'village committee approach,' which involves farmers in both the development of the technologies and their dissemination.

The more important of the two technologies, known as improved fallow, requires farmers to plant fast-growing, nitrogen-fixing shrubs on plots of land that are left fallow for one cropping season. The other involves a practice known as biomass transfer. Leaves from shrubs such as *Tithonia diversifoli,* often grown off-farm, are cut by farmers and incorporated into the soil as green manure when planting crops. Both practices can significantly increase soil fertility and crop yields.

After a period of intensive dissemination, 91% of farmers in the study villages in Vihiga district and 53% of farmers in Siaya district had either stopped using the technologies after experimenting with them, or never adopted them. Furthermore, many of those who did use the technologies were found to be 'pseudo-adopters'; they adopted the practices not because they improved soil fertility, but because they provided other benefits, such as access to credit or the chance to sell tree seeds back to the project.

Evelyne Kiptot, a scientist at KEFRI and consultant to the World Agroforestry Centre, subsequently examined the uptake of the technologies in villages beyond the 17 pilot sites. "The results were very disappointing," she

says. “Even among those farmers who’d heard about the technologies, uptake was very low.” Just a third of the 103 farmers interviewed had heard of biomass transfer, and although many experimented with it, the majority later rejected it. A higher number, 43%, had heard about improved fallow technologies, yet only 13% used them.

In Vihiga district, average farm size is a meagre 0.5 ha, and the average family consists of 7 to 8 people. Many families are too poor to consider foregoing one season of crops, which they are obliged to do if they adopt improved fallow technologies. Indeed, farming families who have adopted agroforestry technologies have tended to be those who are better off and have larger landholdings. Kiptot also believes that a lack of knowledge may have hampered adoption. “Agroforestry technologies are very knowledge intensive, and some farmers in the study area simply don’t have the skills to adopt them, even if they want to,” she says.

According to Kiptot, extension agencies need to rethink their strategy for reaching farmers in areas like Western Kenya. “Agroforesters should recognize that technologies may not suit every farmer and farm condition.”

In the meantime, researchers need to come up with a low-cost approach that provides technical backup to the spontaneous diffusion of agroforestry innovations.

Kiptot, E. 2007. Seeing Beyond fertiliser trees: A Case Study of a Community Based Participatory Approach to Agroforestry Research and Development in Western Kenya. PhD Thesis, Wageningen University and Research Centre, The Netherlands.

©Photo Jianchu Xu

> **Previously malnourished communities are now producing their own trees and growing chestnut, peaches, pears and other fruits.**

Rural revival in North Korea

The collapse of the Soviet Union in 1989 had a devastating impact on the Democratic People's Republic of Korea. Subsidies to the nation ceased, agricultural output fell and hunger and extreme poverty spread across the countryside. In desperation, many people began to open up 'sloping lands' – most of the country is mountainous – to grow food. The result was frequently disastrous: deforestation, combined with heavy rains and inappropriate farming practices, led to landslides and severe erosion.

In 2004, the Swiss Agency for Development Cooperation (SDC) and the Ministry of Land and Environmental Protection launched a project to restore degraded land in Suan County. In 2007, SDC and the Ministry invited the World Agroforestry Centre to provide training and technical advice.

The project began with just three user groups, each with 10 members and 10 ha of land. By early 2011, there were 87 groups in eight counties. "Previously malnourished communities are now producing their own trees and growing chestnut, peaches, pears and other fruits," says Jianchu Xu, the World Agroforestry Centre's coordinator for China. "This has had a dramatic impact on people's lives."

Jianchu believes the success of the project owes much to the willingness of the authorities to acknowledge the user groups' rights to use the land, harvest and sell their crops and plan their activities. This is a highly unusual state of affairs in a country where the State has traditionally exercised rigorous control over every aspect of people's lives.

Local entrepreneurship, combined with active research, has encouraged the spread of agroforestry, with different systems chosen to suit the prevailing conditions. Innovations include double cropping of annual food crops with strips of high-value timber, medicinal plants and fruit trees.

The World Agroforestry Centre will continue to provide advice to DPR Korea and intends to recruit local PhD students to develop land-use planning and landscape health-monitoring systems.

> The project aims to increase yields and improve the livelihoods of tens of thousands of cocoa farming families.

©Photo Charlie Pye-Smith

Reviving cocoa in Côte d'Ivoire

In 2010, the World Agroforestry Centre and Mars Inc, one of the world's largest chocolate producers, launched a major public-private partnership – known as Vision for Change – in Côte d'Ivoire. The project aims to increase yields and improve the livelihoods of tens of thousands of cocoa farming families. This will primarily be done by rehabilitating old cocoa gardens using high-yielding varieties of cocoa and good agricultural practices.

Despite the political turmoil in Côte d'Ivoire, following disputed elections, 13 technicians – nine employed by the World Agroforestry Centre and four by national partners – travelled to Indonesia in 2011 for a training programme led by Mars staff at its Cocoa Development Centre in Sulawesi. Christophe Kouame, the Centre's project manager in Côte d'Ivoire, made a similar journey. The Ivorians learnt about grafting, disease management and other important issues, as well as the institutional arrangements trialled and tested by Mars and local farmers.

The Sulawesi story is told in full in a 'Trees for Change' booklet, *Cocoa Futures.* Thanks to the activities promoted by Mars and its partners, many Indonesian cocoa farmers have more than doubled their yields and incomes. Farmers have learned about new production techniques through demonstrations at cocoa development centres, which in turn support a network of farmer-owned 'village cocoa clinics'.

In 2010, Kouame and his staff established two cocoa-development centres in Soubré region, Côte d'Ivoire, each of which now services a network of *centres villageoises de cacaoculture*. Many more cocoa development centres will be established over the coming years.

When the project was first proposed, it was suspected that Mars and its partners wanted to increase production in order to reduce prices. "We had to convince them that this wasn't the case," says Tony Simons, who was World Agroforestry's deputy director general when the project was launched. At present, farmers have an average of 3 hectares each, with yields of around 400 kg per hectare. "If we can push yields up to 1000 kg per hectare, then farmers could produce the same amount of cocoa on just over a third of their land. They could then devote the rest of their land to timber, fruit and other crops."

The project will not only improve cocoa productivity in Côte d'Ivoire, but encourage farmers to plant a mosaic of different crops and restore a degraded environment. This should dramatically improve the welfare of rural communities, and ensure that Mars and its competitors have a high-quality supply of the raw material they need to prosper in future.

Pye-Smith C. 2011. *COCOA FUTURES: An innovative programme of research and training is transforming the lives of cocoa-growers in Indonesia and beyond.* Trees for Change No 9. Nairobi: World Agroforestry Centre.

©Photo Michael Goldwater

> For me, the big highlight during the past year has been the new partnership we have created in Rwanda.

Reviving research in Rwanda

A small organization like the World Agroforestry Centre would have relatively little influence if its scientists worked in isolation. That is why partnerships – with national research institutes, universities, non-governmental organizations, private businesses, farmers' groups and others – are so important. At the last count, scientists at the Centre had formal partnerships with over 1000 different institutions and individuals across the globe.

"For me, the big highlight during the past year has been the new partnership we have created in Rwanda," says August Temu, Director of Partnerships at the headquarters in Nairobi.

In early 2010, Temu and colleagues visited Rwanda to devise a new strategy. A partnership with a government research institute, established several years earlier, simply was not working. It was time to change tack. Following discussions with government officials, Temu and his colleagues approached the Institute of Scientific and Technological Research, known by its French acronym IRST. The Director General, Jean-Baptiste Nduwayezu, who has an agroforestry background, immediately expressed his enthusiasm for a new partnership and IRST offered the Centre office space at its headquarters in Butare.

In 2010, Athanase Mukuralinda, a Rwanda scientist who conducted his PhD studies with support from World Agroforestry, was appointed country representative. He developed a new strategy for research, linking with the National University of Rwanda's Faculty of Agriculture. Graduate students will now undertake thesis research at the Centre's office, under joint supervision with the faculty.

"I'm convinced that the new partnership will yield significant results, both in terms of research and in helping to transform the livelihoods of rural communities," says Temu. "The Government of Rwanda has made it very clear that it wants us to engage more fully in research in the country, and I think we have a very bright future there."

©Photo Charlie Pye-Smith

> Evergreen agriculture is a farming system where trees are intercropped with annual food crops, retaining a green cover through the year.

Launching an evergreen future

If you had visited Niger in the late 1980s, you'd have seen a landscape devastated by drought. Take a trip through the south of the country today, and you will find a very different place. Almost 5 million ha of agricultural land now boast significant tree cover, thanks to a process of natural regeneration managed by the country's farmers and encouraged by the authorities. This is 'evergreen agriculture' in action.

This was one of the key success stories discussed at an international conference held in Niamey, Niger, in January 2011. Hosted by the Government of Niger and organized by the World Agroforestry Centre, the African Forest Forum, the Africa Regreening Initiative and other organizations, the conference provided an opportunity to explore the ways in which agroforestry can improve food security and environmental resilience across the Sahel.

Evergreen agriculture is a farming system where trees are intercropped with annual food crops, retaining a green cover throughout the year. The trees help to improve fertility and yields, and provide farmers with livestock fodder, fuel, timber and other products. Yields of millet, a staple crop in Niger, continue to increase, even when tree density – the favoured species here being *Faidherbia albida* – exceeds 200 per hectare.

Conference participants identified national and regional measures to scale up evergreen agriculture. "The experience in Niger gives us confidence that it is possible to achieve a positive transformation in farming livelihoods and environmental rehabilitation across the Sahel," said Dennis Garrity, Director General of the World Agroforestry Centre.

The following month, Garrity joined Pal Singh, World Agroforestry Centre Regional Coordinator for South Asia, to launch the South Asian Network on Evergreen Agriculture at the Swaminathan Research Foundation in Chennai, India. Professor MS Swaminathan, the father of the Green Revolution in India and an ardent supporter of agroforestry, helped to launch the network.

The network will advise local farmers on practices that encourage natural regeneration using indigenous trees in arid landscapes. It will also help to identify tree-based management regimes to replenish soil fertility, promote evergreen agriculture using a range of different tree species and share information among partners. All countries belonging to the South Asian Association for Regional Cooperation are represented in the network, which will initially be coordinated by the World Agroforestry Centre's regional office in New Delhi.

Making the most of the market

Two sides of the same story. Farmers and retailers get a better price for their custard apples when they stack them carefully, rather than just dump them.

The agroforestry market in India is increasingly important for smallholders who derive a significant portion of their income from fruits, nuts, medicines, dyes, resins and other tree products. Some are sold at the farm gate, others to wholesalers and some through brokers. Some are sold fresh, some in semi-processed form.

The World Agroforestry Centre is working with a number of companies involved in the retail of fruits, medicines and other tree products to assess the value chain and the market demand. It is also helping smallholders get better returns for their produce by providing training on how to collect, sort, grade, package and transport their produce. During the past year, the Centre has encouraged producers to set up cooperatives and federations to increase their bargaining power, reduce the cost of inputs and market their produce.

The World Agroforestry Centre and the new CGIAR

In December 2009, the CGIAR opened a new chapter in its 39-year history by adopting a new business model based on two years of consultations. The new model for the CGIAR emphasizes clear lines of accountability and balances responsibilities between those who conduct research and those who fund it. It opens the system to stronger collaboration and partnership with other research and development actors.

A balanced partnership

The core pillars of the new partnership are the CGIAR Fund and the Consortium of CGIAR Centers. The Consortium unites the international agricultural research centers supported by the CGIAR and provides a single contact point for donors. Donors will join together in the CGIAR Fund, with the aim of harmonizing their contributions to agricultural research for development, improving the quantity and quality of funding available, and engendering greater financial stability. Reinforcing this two-pillar management structure are various bridging mechanisms, including a Strategy and Results Framework (SRF), which guides the development of a results-oriented research agenda.

Results-oriented research

The research agenda set out by the SRF will be implemented through a portfolio of CGIAR Research Programmes (CRPs – Table 1), although by mid-2011 not all of them had been approved. In each programme, there will be a lead Centre based on its mandate and infrastructure in that area. World Agroforestry's agenda relates to seven of the 15 CRPs, with a large proportion of its research and budget in CRP6 Forests, Trees and Agroforestry. This programme has three objectives:

1. Enhanced human security through mitigation of forest and tree-based sources of emissions and carbon stock enhancement, and increased local and societal resilience through forest, agroforestry and tree-based adaptation measures
2. Improved livelihoods from forest, agroforestry and tree-based sources of income
3. Maintained or enhanced forest and tree-based sources of environmental services, including biodiversity.

The Centre leads CRP components 6.1 Smallholder production systems and markets and 6.3 Landscape management for environmental services, biodiversity

conservation and livelihoods. World Agroforestry participates in the three other components.

Component 6.1 seeks to enhance productivity and sustainability of smallholder forestry and agroforestry practices, including food security and nutritional benefits, through better management of production systems. It will also increase income generation and market integration for smallholders through utilization of forestry and agroforestry options. In addition, improving policies and institutions will enhance social assets and secure rights to forests, trees and land.

Research in Component 6.3 will work to understand the drivers of forest transition at the landscape scale and developing options for their mitigation. Further work will show the consequences of forest transition for sustaining and provisioning environmental goods and services to benefit livelihoods of the poor and disadvantaged. Finally, a network of learning landscapes will be established in which local monitoring and evaluation, coupled with adaptive management, link stakeholder interests to actual performance and opportunities to change incentives at the landscape scale and, through cross-site comparison, at the national and regional scales.

Table 1. CRP budgets

CGIAR Research Programmes (CRPs)		Lead Centre	Budget *(US$ '000)*	% of ICRAF Budget
CRP 1.1	Integrated agricultural production systems for dry areas	ICARDA	22,578	3
CRP 1.2	Integrated systems for the humid tropics	IITA	26,885	3
CRP 1.3	Harnessing development potential of aquatic systems	Worldfish	5,223	0
CRP 2	Policies, institutions and markets	IFPRI	54,273	13
CRP 3.1	Wheat: food security & livelihoods of the poor	CIMMYT	23,130	0
CRP 3.2	Maize: food security & livelihoods of the poor	CIMMYT	39,783	0
CRP 3.3	GRiSP: a global rice partnership	IRRI	68,884	0
CRP 3.4	Roots, tubers and bananas	CIP	31,082	0
CRP 3.5	Grain legumes	ICRISAT	17,743	0
CRP 3.6	Dryland cereals	ICRISAT	14,937	0
CRP 3.7	Sustainable increase livestock and fish	ILRI	14,179	0
CRP 4	Agriculture for improved nutrition and health	IFPRI	25,420	2
CRP 5	Durable solutions water scarcity and land degradation	IWMI	49,077	12
CRP 6	Forest, trees and agroforestry	CIFOR	40,220	45
CRP 7	Climate change, agriculture and food security	CIAT	22,737	12
Total			**456,000**	

2011 International Year of Forests

©Photo Sherry Odeyo

Marking the launch of the International Year of Forests by the United Nations Forum on Forests (UNFF9) in New York on 29 January, Dennis Garrity, the Director General of the World Agroforestry Centre, highlighted the importance of mixing trees with agriculture. “Over a billion hectares of agricultural land, almost half of the world’s farmland, have more than 10 percent of their area occupied by trees,” said Garrity, “and 160 million hectares have more than 50 percent tree cover.”

Later, speaking at the High Level Dialogue of UNFF9 on 3 February 2011, Garrity said, “Agroforestry is a crucial bridge between forestry and agriculture. Essentially, agroforestry is about the role of working trees in agricultural landscapes, particularly on, but not limited to, small-scale farms.”

Adopting the slogan “Working trees that keep on giving,” the Centre worked to integrate activities to celebrate the Year into its communications programme. The Centre participated actively with the Collaborative Partnership on Forests (CPF - www.fao.org/forestry/cpf/en/), which is a voluntary arrangement among 14 international organizations and secretariats with substantial

programmes on forests. Each month, several of the partners took the lead on developing and issuing a press release dealing with a particular aspect of forests. With the UN imprimatur, these statements featured widely in the world media. World Agroforestry contributed to most of the statements, and worked actively to develop those concerned with “Forests for People: Community-based Forest Management” and “Forests, Food Security and Agriculture.”

Another element in the public awareness strategy was an intensified effort throughout the Year to place stories about the impact of Centre research with major media outlets at least once a month. A typical example was a story entitled “Why farming with trees boosts climate security” by the Reuters news agency (see www.trust.org/alertnet/news/expert-views-why-farming-with-trees-is-climate-security).

The Communications Unit developed an exhibition entitled “Working trees that keep on giving: an exhibition demonstrating the power of agroforestry, trees on farms and in the landscape.” This display consisted of 30 panels with colourful photographs and simple text explaining aspects of agroforestry. As a way of quickly highlighting the value of agroforestry to new audiences, the exhibition was shown at a number of major international meetings throughout the Year, including the World Bank Investment Forum in Nairobi, Kenya, the FAO-sponsored First Drylands Week in Dakar, Senegal, the University of Leeds, UK meeting on “Food security, Health and Impact Knowledge Brokering,” and the 10th Conference of the Parties of the UN Convention to Combat Desertification, in Changwon, Republic of Korea.

Bringing the subject to a much wider audience in the Centre’s host country, the exhibition was also placed in the National Museum of Kenya in Nairobi, for the months of July and August. During this time, as well as the usual stream of visitors, a series of groups of Kenya schoolchildren were shown the display and involved in school activities related to agroforestry.

In another sort of public awareness initiative, the BusyTrees campaign was launched at the Glastonbury Rock festival in the UK by Scriptoria Communications on behalf of World Agroforestry. Featuring several dedicated websites (busytrees.com and treesonfarms.com), the campaign uses cartoon characters, a petition, social media sites and public engagement to spread the word about agroforestry to the general public.

“The International Year of Forests is a momentous opportunity to more fully recognize the tremendous importance of agroforestry and evergreen agriculture in building a better world,” noted Garrity. “Agroforestry is one of mankind’s best hopes to create a climate smart agriculture, increase food security, alleviate rural poverty, and achieve truly sustainable development. And, thereby, better ensure that our world’s forests can indeed be conserved far into the future.”

Annexes

©Photo Steve Mann

Our people

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(ex-officio)

Juan Mayr

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Romano Kiome
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Rita Sharma

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Anthony Simons, Deputy Director General

Laksiri Abeysekera, Director of Finance and Operations

August Temu, Director of Partnerships

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Kamini Balram, Head of Human Resources

Thomas Zschocke, Head of Training Unit *(joined 2011)*

Steven Franzel, Leader, Global Research Project - Tree Product Marketing and Extension

Ramni Harmanjeet Jamnadass, Leader, Global Research Project - Quality Trees

Antoine Kalinganire, Co-Leader, Global Research Project - On-farm Productivity

Ian Moore, ICT Manager

Jeremias Gasper Mowo, Regional Coordinator - Eastern Africa

Heinrich Neufeldt, Leader, Global Research Project - Climate Change

Frank Place, Impact Assessment Advisor

Roberto Porro, Regional Coordinator - Latin America

Ujjwal Pradhan, Regional Coordinator - Southeast Asia

Keith Shepherd, Leader, Global Research Project - Land Health

Fergus Sinclair, Co-Leader, Global Research Project - On-farm Productivity

Virendra Pal Singh, Regional Coordinator - South Asia

Zacharie Tchoundjeu, Regional Coordinator - West and Central Africa

Paul Stapleton, Head of Communications Unit

Meine van Noordwijk, Chief Science Advisor

For a full staff list, please see the comprehensive version of this report at www.worldagroforestry.org/ar2011

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AGEFO
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Australian Aid
Austria
Africa Wildlife Foundation
Belgium
Biodiversity Transect Monitoring Analysis in Africa
Bill and Melinda Gates Foundation
BOTH ENDS (Environment and Development Service)
BridgeStone
Brazil
British Trust for Ornithology
Chinese Academy of Science
CATIE
Climate Change, Agriculture and Food Security
Cooperation of Common Fund for Commodities
Center for International Forestry research
China
Centro Internacional de Agricultural Tropical, Colombia
Canadian International Development Agency
Centre for Mountain Ecosystem Studies
Common Market For East and Southern Africa
Comart Foundation
Cornell University
Concern Worldwide
Centre de Coopération Internationale en Recherche Agronomique pour le Développement
Technical Centre for Agricultural and Rural Co-operation
Department for International Development
Packard Foundation
Ebony Enterprises Ltd
Earth Institute - Columbia University
European Union
Food and Agriculture Organization of the United Nations
Forum for Agricultural Research in Africa
Finland
Danish Centre for Forest, Landscape and Planning
Ford Foundation
Georg-August-Universitat Gottingen
Global Environment Facility
Global Food and Farming Futures
Deutsche Gessellschaft fur Technische Zusammenarbeit - GTZ
Heifer International
HK Logistics LTD. Global Solutions
Harvard University
World Bank
International Center for Agricultural Research in the Dry Areas
India Council for Agricultural Research
International Cooperation Center for Agricultural Education - Nagoya University
International Crop Reseach Institute for the Semi Arid tropics
International Development Research Centre
International Fund for Agricultural Development
International Food Policy Research Institute
International Institute for Sustainable Development
International Livestock Research Institute
International Network for Bamboo and Rattan
Bogor Institute of Agriculture
International Plant Genetic Resources Institute
Indonesian Palm Oil Commission
Ireland
Italy
World Conservation Union
International Water Management Institute
Japan
Japan International Research Center For Agricultural Sciences
Kenya Agricultural Research Institute
Kenya
Consortium for Study and Development of Participation
Kyoto University
Katholic University
LEUSER NOEL
Mars Inc
Millenium Challenge Account
McKnight Foundation
Macaulay Land Use Research Institute
Republic of Maldives
Multidonor
North Carolina State University
Netherlands
Norwegian Agency for Development Cooperation
Norway
Natural Resources Institute
National Smallholder Farmers' Association of Malawi
PanEco Foundation for Sustainable Development and Intercultural Exchange
Peru
Partnership for Governance Reforms in Indonesia
Plan International
Philippines
Rwanda Agricultural Development Authority
Rockefeller Foundation
Rights and Resources Group
Government of Rwanda
Scottish Agricultural College
Swiss Development Corporation
Swedish International Development Cooperation Agency
Swedish University of Agricultural Sciences
South Africa
Spain
Tegemeo Institute of Egerton University
The Nature Conservancy
United Nations Development Programme
United Nations Environmental Programme
Unilever
United Nations Office at Nairobi
United Nations Office for Project Services
United States Agency for International Development
Wajibu MS Ltd
Waseda Environment Research Institute
William J. Clinton Foundation
World Wildlife Fund
Leibniz Centre for Agricultural Landscape Research
Centre for Development Research

Financial highlights

Statement of Financial Position

As at 31st December 2010 *(In US Dollars '000)*

	Note	2010	2009
ASSETS			
Current assets			
Cash and cash equivalent	5	16,940	16,436
Short term investments	6	10,368	13,624
Accounts receivables			
Donor	7	9,345	4,799
Employees	8	96	198
Other CGIAR Centres	9	186	277
Other	10	2,596	2,781
Inventories - net	11	88	95
Prepaid expenses	12	839	797
Total current assets		40,458	39,007
Non-current assets			
Property and equipment	13	5,429	5,493
Long term investments	14	5,044	2,108
Total non-current assets		10,473	7,601
TOTAL ASSETS		**50,931**	**46,608**
LIABILITIES AND NET ASSETS			
Current liabilities			
Accounts payable			
Donor	15	12,241	15,057
Employees	16	1,012	885
Other CGIAR Centres	17	428	344
Other	18	1,805	917
Accruals	19	4,483	4,027
Total current liabilities		19,969	21,230
Non-current liabilities			
Accounts payable			
Employees	20	5,410	5,014
Total Non-current liabilities		5,410	5,014
TOTAL LIABILITIES		25,379	26,244
NET ASSETS			
Unrestricted			
Designated	21	15,939	12,168
Undesignated	21	9,613	8,196
Total Net Assets		25,552	20,364
TOTAL LIABILITIES AND NET ASSETS		**50,931**	**46,608**

The financial statements were approved by the Board of Trustees on 8 April 2011

Statement of Activities

For the year ended 31st December 2010 *(In US Dollars '000)*

		2010			2009
		Unrestricted	Restricted		
	Note		Temporarily	Total	Total
Revenue, Gains and other Support					
Grant revenue	22	14,240	26,691	40,931	32,269
Other revenue and gains	23	2,123	-	2,123	2,981
Total revenue and gains		16,363	26,691	43,054	35,250
Expenses and losses					
Programme-related expenses	24	10,086	20,741	30,827	26,384
Management and general expenses	25	3,911	449	4,360	5,124
CGIAR Gender and Diversity Program	26		5,501	5,501	4,227
Sub total expenses and losses		13,997	26,691	40,688	35,735
Overhead cost recovery	27	(2,822)		(2,822)	(2,086)
Total expenses and losses		11,175	26,691	37,866	33,649
Net Surplus / (Deficit)		5,188	-	5,188	1,601
Expenses by natural classification					
Personnel costs		7,489	8,365	15,854	14,297
Supplies and services		3,439	10,963	14,402	13,939
Collaborators/partnerships		905	3,275	4,180	3,667
Operational travel		1,594	3,698	5,292	3,053
Depreciation		570	390	960	779
Overhead cost recovery		(2,822)		(2,822)	(2,086)
Total		**11,175**	**26,691**	**37,866**	**33,649**

Board statement on risk management

The Board of Trustees and Management of the World Agroforestry Centre have reviewed the implementation of the risk management framework during 2010 and the Board is satisfied with the progress made.

The Board of Trustees has the responsibility of ensuring that an appropriate risk-management process is in place to identify and manage current and emerging 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 reputational 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:

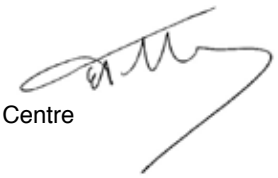
- Misallocation of scientific efforts away from agreed priorities
- Loss of reputation for scientific excellence and integrity
- Business disruption and information system failure
- Liquidity problems
- Transaction processing failures
- Loss of assets, including information assets
- Failure to recruit, retain and effectively utilize qualified and experienced staff
- Failure in staff health and safety systems
- Failure in the execution of legal, fiduciary and Centre responsibilities
- Withdrawal or reduction of funding by donors due to the financial crisis
- Lack of funding to, or non-prioritization of agroforestry in the CRPs due to the CGIAR change management process
- Subsidization of the cost of projects funded from restricted grants and/or partial non-delivery of promised outputs, due to inadequate costing of restricted projects.

The Board has adopted a risk management policy 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 draws upon risk assessments and analysis prepared by staff of the Centre's business unit, internal auditors, Centre-commissioned external reviewers and the external auditors. The risk assessments 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 risk. 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 Finance and Audit Committee.

The Board also remains very alive to the impact of external events over which the Centre has no control other than to monitor and, as the occasion arises, to provide mitigation.

Eric Tollens
Chair
Board of Trustees
World Agroforestry Centre
8 April 2011



Performance indicators

The Performance Measurement (PM) System of the Consultative Group on International Agricultural Research (CGIAR) measures the performance of the Centres it supports in terms of their results and potential to perform.

This PM System provides the Centres with a method to better understand their own performance and demonstrate accountability. Due to the ongoing changes in the CGIAR Consortium, the Performance Measurement Exercise was not conducted Centre-wide this year. However, ICRAF did collect some information for its own internal use. The results are presented below.

Results for the World Agroforestry Centre

1. Composite measure of Centre research publications:

1A: Number of peer-reviewed publications per scientist in 2010 that are published in journals listed in Thomson Scientific/ISI: 0.90

1B: Number of externally peer-reviewed publications per scientist in 2010 (excluding articles published in journals listed in the Thomson Scientific/ISI): 1.05

2. Percentage of scientific papers that are published with developing country partners in refereed journals, conference and workshop proceedings in 2010: 19.5%

INSTITUTIONAL HEALTH

Diversity

5D: Percentage of women in management: 33%

Financial health

6A: Long-term financial stability (adequacy of reserves): 199 days where the minimum benchmark is 75 days

6B: Cash management on restricted operations: 0.38 where the benchmark is less than 1.0

Selected publications

Occasional Paper

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For a comprehensive list of publications, visit our publications page: http://worldagroforestry.org/our_products/publications

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TRANSFORMING LIVES AND LANDSCAPES

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