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XIII WORLD FORESTRY CONGRESS

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XIII World Forestry Congress

The World Forestry Congress is the world's largest gathering focused on forests and forestry, and the thirteenth congress was the largest ever, with more than 7 000 attending. Held in Buenos Aires, Argentina from 18 to 23 October 2009, the congress offered stimulating presentations, discussions, meetings and exhibits for forest watchers and workers of every kind.

This issue of *Unasylva* summarizes the event and provides a taste of the impressive variety of knowledge and information presented there. It begins with an overview by O. Serrano describing the congress and summarizing a number of special events, as well as the strategic actions recommended by the congress in its final declaration.

The bulk of the issue is developed from papers presented in Buenos Aires. The content is organized around the seven main thematic areas of the congress. We have selected material with potential appeal for a broad audience, representing a wide geographic range and presenting topics not recently covered in *Unasylva*.

Theme 1, "Forests and biodiversity" covered, among others, issues related to the state of the forest and deforestation, including many technical contributions on forest inventory and assessment. We present a study by R.S. Purnamasari examining the role of poverty and regional socio-economic development in the dynamics of small-scale deforestation in Indonesia. The results show that regions with the highest percentage of poor people actually have less deforestation, probably because people with some means to invest in agricultural production are more likely to deforest. Deforestation at first increases with wealth, but decreases after a certain wealth level is reached. Also under Theme 1, a shorter piece (by E. Durán, J.J. Figel and D.B. Bray) reports the results of a study of the potential for community conservation of jaguars in four communities in the Sierra Norte of Oaxaca, Mexico.

Theme 2, "Producing for development", included all aspects of forest production. One of its subthemes, forests and energy, was also discussed in a special half-day forum. M. Jack and P. Hall examine the potential of developing large-scale forests for bioenergy in New Zealand, and the implications for land-use, the economy and the environment.

Under Theme 3, "Forests in the service of people", an important subtheme was valuation of environmental services. S. Wu, Y. Hou and G. Yuan describe an attempt to estimate the complete market and non-market values of the forests of Beijing municipality, China. The study also examined the sectoral and spatial distribution of the forest benefits. The authors acknowledge that efforts to assign an economic value to all forest benefits – and the methods for doing so – may be open to debate, but they are useful to raise awareness of the multifunctional roles of forest ecosystems and can ultimately help contribute to forest conservation.

Theme 4, "Caring for our forests", is represented by a study of the impact of fire in seasonal semideciduous forest fragments in São Paulo State, Brazil. A.C.G. Melo and G. Durigan find that tree recovery at the forest edges is slower than in the interior, suggest why, and draw conclusions for fire management and prevention in forest fragments.

Under Theme 5, "Development opportunities", J. Kamugisha-Ruhombe examines planning, budgeting and fiscal resource allocation for forestry in Uganda, illustrating the gap between the global discussion on forest finance and national realities in heavily indebted poor countries. He finds that budget ceilings established by Uganda in order to qualify for debt relief are the main reason for the country's low financial allocations to forestry. A shorter piece (by E. Atmiş, H.B. Günşen and S. Özden) examines forest cooperatives in Turkey and the constraints that prevent them from contributing to poverty reduction as well as intended.

Theme 6, "Organizing forest development", included a wide range of macroeconomic, institutional and governance issues. A. Ramadhani describes a project to promote good forest governance for sustainable livelihood improvement in four forest-adjacent villages in the United Republic of Tanzania. He summarizes the outcomes two years after the project, and recommends measures for promoting good governance that may also be applicable elsewhere.

For Theme 7, "People and forests in harmony", we include the introductory paper for the subtheme "Work in the forestry sector". C. Ackerknecht reviews topics such as labour unions, occupational health and safety, training and changes in the workforce. The article is global in scope, but makes particular reference to Chile.

The issue concludes with a provocative essay in which H. Savenije and K. van Dijk surmise forest sector trends since the previous World Forestry Congress in 2003 based on their observations in Buenos Aires. Although an earlier version of this article has already been circulated widely through the Internet, it is included here to stimulate readers to consider the wider implications of the XIII World Forestry Congress for the future of forestry. We hope this whole issue of *Unasylva* will serve the same purpose.

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XIII World Forestry Congress – Forests in development: a vital balance

O. Serrano

Facts, figures and highlights from the largest forestry gathering ever.

Olman Serrano, Senior Forestry Officer, FAO, was Associate Secretary General of the XIII World Forestry Congress.

The first World Forestry Congress was held in 1926, the second ten years later, and congresses have been organized approximately every six years since 1949, in partnership between FAO and a host country. The XIII World Forestry Congress, held in Buenos Aires, Argentina from 18 to 23 October 2009, was the largest forestry gathering ever. Over 7 000 experts had the opportunity to present and discuss their work, share their experiences and increase their networks across the continents. Participants from 160 countries gathered at the exhibition grounds of the conference centre La Rural to exchange views around the theme of the congress, "Forests in development: a vital balance".

Participants – who take part as individuals and do not represent their countries or organizations – came from all continents, with the greatest part, as expected, from Central and South America, and fully half from Argentina. They included policy-makers (including a number of ministers responsible for forestry), researchers, forest practitioners and representatives from industry, financial institutions and development agencies. All 14 members of the Collaborative Partnership on Forests (CPF) were represented, as were many non-governmental organizations. The attendance of students was remarkable: some 1 200 representing a broad range of universities, many supported by associations such as the International Forest Students Association (IFSA) and the Latin

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Leopoldo Montes, Secretary General of the XIII World Forestry Congress, welcomed participants to the congress on Sunday evening, 18 October

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FAO Director-General Jacques Diouf addressed the opening plenary, noting that considering forests as an integral part of wider economic and social development goals will help greatly in efforts to reduce poverty, hunger and malnutrition

Near East Forestry Day
19 October 2009

Near East Forestry Day was organized in conjunction with the XIII World Forestry Congress, under the aegis of the FAO Near East Forestry Commission, to share with the international forestry community the key concerns of forestry in the Near East and North African Region – including rangelands and biodiversity conservation, wildlife and protected areas, forest plantations in arid and semi-arid zones and the role of Near East forestry in the international dialogue

This special event offered a unique opportunity for forestry experts, policy-makers and representatives from government, the private sector and non-governmental organizations (NGOs) to exchange views and experience, explore business opportunities and interact with high-level panellists from the region. It attracted representatives from Egypt, Jordan, Lebanon, Morocco, Saudi Arabia, the Sudan, the Syrian Arab Republic, Tunisia and Yemen, among others.

The gathering raised awareness on the need to share lessons learned and to follow up results achieved in addressing desertification, degradation of forests and woodlands, water scarcity and soil erosion. Participants underlined that further efforts should be developed to integrate appropriate forest policies and strategies in general land resources management. Much attention was focused on how to mobilize the necessary resources to reverse the declining trend of forest resources in the region. Participants also emphasized the importance of collaboration between the private and public sectors and among governments, NGOs and research institutions, as paramount for the promotion and valorization of forest products and services in drylands.

A concrete outcome was a set of recommendations and conclusions, developed by a core team of forest experts attending the event, to be presented to the next session of the Near East Forestry Commission, to be held in Tunis, Tunisia from 5 to 9 April 2010.

American Forest Science Students Association (ALECIF).

Nearly 600 participants came from Africa and Asia. More than 200 participants from developing countries were able to attend thanks to a sponsorship programme coordinated by FAO and financially supported by the governments of Finland, Spain, the United Kingdom and the United States of America.

For the first time, countries from the Near East were strongly represented at the World Forestry Congress and organized a special event to present their common concerns (Box).

While the World Forestry Congress is a global technical forum, it attracted the interest of high-level policy-makers. Most of the world's heads of forestry services were present. The host country organized a ministerial event attended by ministers responsible for forestry in Argentina, Chile, China, Costa Rica, New Zealand and the Republic of the Congo.

CONGRESS PROGRAMME

The technical programme included 282 presentations, selected from over 3 000 abstracts submitted, covering the seven main thematic areas and 42 subthemes:

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To celebrate the opening of the congress, Cristina Fernández de Kirchner, President of Argentina, planted a tree at the Casa Rosada – the presidential headquarters – symbolizing the country's commitment to the conservation and management of forest resources

- ***Forests and biodiversity*** – state of the forest and assessment techniques, deforestation and forest fragmentation, restoration and rehabilitation, biodiversity, conservation management, wildlife, forest genetic diversity;
- ***Producing for development*** – forest management, planted forests, agroforestry systems, maintaining and increasing forests' productive capacity, forests and energy, forest utilization practices, non-wood forest products, trees outside forests and other wooded land;
- ***Forests in the service of people*** – forests and water, forests and climate change, tourism and recreation, urban and peri-urban forests, mountain forests and livelihoods, valuation of environmental services and benefit sharing;
- ***Caring for our forests*** – forest fire, invasive species, pests and diseases, other disturbances;
- ***Development opportunities*** – sustainability and economic viability, industry and forest development, small and medium-scale forest enterprises, forest products trade, forest certification, forests and poverty alleviation;
- ***Organizing forest development*** – international dialogue and processes, instruments for forest planning and development, institutional settings, law compliance and good governance, research, extension and education, intersectoral policies and influences, contribution of the forest sector to national and local economies, forest information;
- ***People and forests in harmony*** – land tenure, indigenous peoples, communities and institutions, participatory management and processes, work in the forestry sector, gender and forestry.

Sixteen invited keynote speakers introduced the main thematic areas in plenary.

Five plenary sessions, 62 technical sessions and three special fora provided multiple opportunities for participants to share and increase their knowledge of forest and cross-sectoral issues. In addition over 100 side events were organized by institutions with particular forest-related interests, including indigenous peoples, mountain ecosystems, biological diversity and financing. More than 1 500 posters were displayed, providing an additional opportunity for presentation of field experiences.

SPECIAL FEATURES

Fora on topical issues

Full-afternoon fora were dedicated to two subjects: forests and energy, and forests and climate change. These well-attended sessions, held in the plenary hall, included high-level keynote presentations followed by substantive panel discussions.

The main outcome from the climate change forum was a message from the organizers of the World Forestry Congress to the fifteenth Conference of the Parties (COP 15) of the United Nations Framework Convention on Climate Change (UNFCCC) (Box p.6).

Participants in the Forests and Energy

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Euclides Pereira, representing the indigenous peoples of the Brazilian Amazon, dismissed the notion of an "untouched" Amazon, for indigenous practices have always involved intervention in nature (including the development of food crops that have contributed to feeding the world); he drew attention rather to indigenous peoples' long experience in conserving their lands, natural resources, water and biodiversity

Forests and climate change: from Buenos Aires to Copenhagen

Linkages of forests and climate change were discussed in four technical sessions (mitigation, impacts and adaptation, policies and institutions, forest carbon and carbon markets), in 14 special events organized by partner organizations, and during a half-day forum entitled "Forestry and climate change: to Copenhagen and beyond".

The results of the various sessions are reflected in the following message from the congress, adopted on Friday, 23 October 2009, to COP 15 of UNFCCC (Copenhagen, Denmark, December 2009):

The XIII World Forestry Congress (WFC) notes with concern the impacts of climate change on forests and strongly emphasizes the important role forests play in climate change mitigation and adaptation as well as the need for forest-dependent people and forest ecosystems to adapt to this challenge.

Forests are more than carbon. They harbor two thirds of all land-based biodiversity, and generate critical ecosystem goods and services such as water, food, and income from over 5 000 commercial forest products. Forests sustain the cultural and spiritual identity of billions of people, foremost among them the indigenous peoples and local communities.

The XIII WFC calls for urgent action and endorses the main messages of the Collaborative Partnership on Forests' Strategic Framework for Forests and Climate Change, of its Expert Panel on Adaptation of Forests to Climate Change, and of The Forests Dialogue's Statement on Forests and Climate Change, in particular the following:

- ***Forests contribute positively to the global carbon balance. Maintaining high carbon stocks by reducing deforestation and forest degradation and promoting the sustainable management of all types of forests, including the conservation of biodiversity, forest protection and restoration, should be among the world's highest priorities for the forestry sector.***
- ***Sustainable forest management provides an effective framework for forest-based climate change mitigation and adaptation.***
- ***For forests to fully achieve their potential in addressing the challenges of climate change, forest governance should be improved, financing and capacity building should be enhanced, and processes to empower disenfranchised people, including indigenous peoples and other forest dependent communities, be strengthened.***
- ***Sustainably harvested forest products and wood fuels can reduce greenhouse gas emissions if they substitute neutral or low emission, renewable materials for high-emission materials.***
- ***Even if adaptation measures are fully implemented, climate change would in the long run exceed the adaptive capacity of many forests and therefore forest-based climate change mitigation and adaptation measures should proceed concurrently.***
- ***Intersectoral collaboration, strengthening forest governance, establishing positive economic incentives, and improving sustainable livelihoods of the poor are essential for reducing deforestation and forest degradation.***
- ***Accurate forest monitoring and assessment help inform decision-making and should be strengthened in a coordinated and transparent manner.***
- ***Actions on climate change mitigation and adaptation in forestry would benefit from a more active engagement of forestry professionals.***

The XIII WFC stresses the need to reduce poverty as a driver of deforestation and to safeguard the rights of indigenous peoples and forest-dependent communities, and recognizes the important roles that the private sector and civil society play in climate change adaptation and mitigation.

The XIII WFC supports the inclusion of REDD-plus in the agreement on long-term cooperative action under UNFCCC, including enhanced incentives for conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries; and calls for further support for adaptation in the forest sector.

Forum debated the implications of bioenergy production for the forest sector. They shared their perspectives on the state of the art of wood-based energy production technologies, the social and environmental impacts of bioenergy production and the opportunities that bioenergy-related policies present for sustainable development (Box opposite).

The Investment and Financing Forum was another innovative event (Box p. 8). Representatives of financial and development institutions, forest and investment funds, private equity funds, forestry enterprises, banks and government representatives discussed strategies on how to overcome the current financial crisis with new business models, industry restructuring, new financing instruments and non-traditional investment opportunities.

Business meetings – for business and others

Parallel to the main programme, space was set aside to accommodate interaction among private-sector participants,

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More than 1 500 contributors presented posters

including forest products producers, traders, financial institutions and investors. On Wednesday 21 October, a full-day Business Roundtable brought together 205 representatives from enterprises involved in forestry-related activities, from 31 countries. Over 1 000 face-to-face meetings were registered, totalling U$35 million in business pledges.

Many forest-related groups and organizations – for example, the Collaborative Partnership on Forests (CPF) and the Board of the International Union of Forest Research Organizations (IUFRO) – held meetings in Buenos Aires prior to the congress week, taking advantage of the presence of experts from around the world. FAO and the German Agency for

Congress participants express caution about bioenergy developments

The Forum on Forests and Energy attracted about 2 500 participants and included presentations from nine speakers covering a wide range of technical and policy issues related to the subject. The discussion came back often to three major issues:

- ***Bioenergy and land-use change.*** **Many presenters noted that the replacement of fossil fuels with biofuels will have significant impacts on land use. Key issues that have to be considered in this respect include the possible conversion of forests to biofuel crops, increased competition for agricultural crops between food and fuel use, and the socio-economic implications of large-scale changes in land use, landownership and land tenure. The use of degraded land and existing biomass wastes reduces the impact of bioenergy developments on land use, but is not entirely without problems.**
- ***Bioenergy technologies.*** **Most biofuel development at present focuses on liquid biofuel production derived from agricultural crops, but the technology to produce liquid biofuels from wood is improving and production is expected to increase greatly in the future. The pulp and paper industry shows keen interest to develop both biochemical and thermochemical technologies to convert cellulose into bioenergy, and the biorefinery concept is expected to be an important technological platform. About US$3.8 billion is currently invested in research and development into such second-generation technologies; they have now reached demonstration plant scale but are still some way from being economically viable compared to existing types of liquid biofuel.**
- ***The use of wood for bioenergy.*** **Wood is already by far the largest source of bioenergy and it will remain so in the future. Much of this is fuelwood and charcoal used in developing countries, but more modern uses of wood for heat and power generation are rapidly becoming more widespread. In general, wood has many advantages for bioenergy production compared with existing alternatives. However, the use of wood for bioenergy will increase total wood demand, so the sustainability of production and competition with other existing wood uses are important issues that should be considered.**

A number of presenters described the ambitious bioenergy policies already in place in North America and Europe and noted that many developing countries are also developing or implementing policies in this area. In addition, several international partnerships are addressing technical and policy issues related to bioenergy and its sustainable development, for example the formulation of principles, criteria and indicators for bioenergy production.

After the technical presentations, the members of the audience voted on whether they thought bioenergy development would be good or bad for the forestry sector. The interesting result was that about 50 percent thought it would be bad and 40 percent thought it would be good (with about 10 percent undecided). Thus, it seems that many issues of concern must be examined and resolved before the forestry community can give its wholehearted support to bioenergy development.

Conclusions from the Investment and Financing Forum 22 October 2009

Participants expressed a concern that investment in tropical forestry is wholly insufficient even though the rate of return on investments in forest plantations and sustainable forest management is in the range of 15 to 25 percent. Less than US$1 billion per year of official development assistance (ODA) is devoted to tropical forestry. The barriers to forest investment in developing economies include the perception of high risk in long-term investments (because of insecure land tenure, political instability, weak institutions and regulatory frameworks, and human rights issues) and limited capacity to absorb investments (because of deficient financial infrastructure, lack of suitable partners and shortage of skills).

To improve the investment conditions in tropical forest countries, it is necessary to bridge four gaps:

- **the investment gap – through local partnerships, reduced bureaucracy and capacity building in forestry, business and financial institutions;**
- **the risk gap for investments – through an enhanced role of the multilateral development banks (long-term loans, insurance for political and land tenure risks, and facilitation of trade financing);**
- **the knowledge gap – through enhanced investor relations, improved price transparency and promotion of country or sector investment plans;**
- **the market gap – through correction of market failures, establishment of fully functioning carbon markets and long-term carbon framework agreements, reduction of transaction costs, strengthening of price signals for sustainable products, capacity building of local banks and support for innovations.**

A mechanism for reducing emissions from deforestation and forest degradation (REDD) that includes conservation, sustainable management of forests and enhancement of forest stocks (REDD-plus) could catalyse economic transformations and increase investments in tropical countries. But deforestation goes far beyond the carbon issue, and the carbon market does not really function yet. Therefore, REDD-plus must be able to foster the establishment of sustainable private enterprises in order to be successful. To put the matter in human terms, some 1.8 billion people use forests and trees for part of their subsistence, some 500 million people directly depend on forest resources for their livelihoods, and some 50 million people live literally within forests. REDD-plus should help these people have a decent life.

Technical Cooperation (GTZ) organized an event on regional forest cooperation. The National Forest Programme Facility met with South American partners. The host country organized a special training course on forest genetics with global specialists a few days before the opening of the congress.

Reaching beyond the forest sector

The World Forestry Congress was not only for foresters to discuss traditional forest topics, but embraced other subjects having an impact on forests. For example, an event lasting almost three days and organized parallel to the main programme was the Second International Forum on Globally Important Agricultural Heritage Systems (GIAHS). Keynote speaker M.S. Swaminathan, winner of the 1987 World Food Prize, called for an "ever-green" revolution based

Valter Ziantoni won first prize in the World Forestry Congress photo contest for his image "Everyday Amazon"

on dynamic conservation of agricultural heritage sites in an era of climate change. The Forum discussed agricultural systems and landscapes created, shaped and maintained by generations of farmers and herders based on diverse natural resources and using locally adapted management practices. These well-balanced agro-ecological systems include agroforestry practices in marginal or extreme environments where trees have an important role. A special address by Henri Djombo, Minister of Forest Economy, the Republic of the Congo, brought forestry into the GIAHS perspective.

Offsetting the carbon footprint of the congress

The enormous participation in the World Forestry Congress entailed high consumption of energy and thousands of kilometres of travel by air, sea or road, adding an enormous amount of carbon dioxide to the atmosphere. To offset these emissions and contribute to climate change mitigation, the congress organizers arranged to purchase carbon credits from a biomass energy project in Brazil – creating the first "carbon neutral" World Forestry Congress.

CLOSING AND DECLARATION

The XIII World Forestry Congress concluded with a final declaration, summarizing the most relevant issues and recommendations resulting from the numerous presentations and discussions throughout the week. The declaration outlined nine findings and 27 strategic actions (Box p.10). Its preamble notes that:

> *Forests are an invaluable asset for humanity providing livelihoods for billions of people, helping achieve environmental sustainability, and serving*

Some scenes from the exhibition hall, including the inauguration by the congress organizers

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Strategic actions recommended by the XIII World Forestry Congress

Working with partners outside the forest sector

- *Initiate integrated cross-sectoral actions at global, regional, national and local scales on key issues, including climate change, bioenergy, water, biodiversity, food security and poverty alleviation to reduce adverse impacts on forests.*
- *Implement mechanisms for cross-sectoral monitoring and reporting to influence policies and actions related to forestry.*

Influencing opinions and perceptions about the value of forests

- *Create innovative mechanisms that incorporate local and indigenous knowledge as a source of valid information to enrich global knowledge and the understanding of sustainable forest management.*
- *Strengthen interfaces between forest knowledge and society; focusing in particular on opinion leaders in local populations, as a way to influence policy-makers.*

Economic mechanisms to take full account of forests' value to society

- *Foster the development of mechanisms at local, regional, national and global levels for realizing new economic values of forests that create financial incentives for landowners and communities to manage for these values.*
- *Focus immediately on climate change related mechanisms as the first priority with particular attention to REDD issues.*
- *Increase efforts to develop integrated policies and strategies for effective management of forest and water resources.*

Planted forests

- *Recognize the importance of planted forests in meeting economic, social and environmental needs.*
- *Focus activities on degraded landscapes, especially restoration of degraded forest lands.*
- *Develop and implement technologies to maintain and enhance the productivity of planted forests and their contributions at local and landscape levels.*

Forest bioenergy

- *Develop energy forests within the context of a sustainability framework to minimize the risk of unintended consequences across the forest, agriculture and energy sectors.*
- *Implement good governance policies for sustainable bioenergy development.*
- *Develop and improve technologies for more efficient production and diverse use of biomass for energy including second generation technologies.*

Forests and climate change

- *Develop new approaches to enhancing carbon sequestration using forests and new options for managing forests in the face of climate changes and implement them widely.*
- *Provide informed and scientifically proved inputs to climate change negotiations.*
- *Simplify AR CDM rules and implementation of REDD-plus.*
- *Advocate that local needs currently met from forests are respected and reflected in international climate change-oriented mechanisms and policies.*
- *Expand research on adaptation to climate change and its impacts on ecosystems, economies and societies.*

Fragile ecosystems, including arid zones, small islands, wetlands and mountains

- *Promote protection and restoration of fragile ecosystems to improve their resilience and adaptation to changing climates and human impacts and to maintain their vital environmental services, including food security and livelihoods for their inhabitants.*
- *Increase efforts to combat desertification through forestry-related actions.*

Forest industry

- *Create an enabling environment of policy and legal framework for the forest industry sector.*
- *Expand research to develop new clean technologies and forest products.*

Forest-related policies, good governance and institutions

- *Improve governance at all levels of the forest sector, including building capacity of forestry institutions to enforce laws and regulations, and facilitate sustainable forest management by state and non-state actors.*
- *Provide better mechanisms to recognize and value women's roles in both informal and formal domains.*
- *Improve worker skills and working conditions needed for safe and productive work in the expanding forest sector.*
- *Promote land tenure reform providing secure rights to communities and local stakeholders to use and manage forest resources.*
- *Develop financing strategies within the framework of national forest programmes using innovative instruments for investment and market development in forestry.*

as a source of social and spiritual values for peoples, communities and nations. Through their sustainable management, forests can contribute to alleviating poverty, safeguarding biodiversity, providing the broad range of goods and services for present and future generations, in the context of a changing climate.

The declaration affirms that sustainable forest management, although not sufficient alone to address the multitude of challenges facing forests, contributes to achieving the vital balance between humanity and nature that is needed for sustainable development, and that ongoing United Nations conventions and processes, such as the Non-Legally Binding Instrument on All Types of Forests, provide useful institutional frameworks for action.

CONCLUSIONS

The whole congress week was rich in technical information exchange and lively discussions, everywhere from the plenary hall and the 14 other meeting rooms to the large exhibition area, the poster section, the ample space for journalists and the comfortable relaxation area.

A congress in Buenos Aires would not have been complete without tango

The well-known Argentinian hospitality, the high-quality cuisine and the ample choice of cultural events made the participants' stay a very pleasant one, despite the tight technical programme and the multitudes attending.

Forestry and people who use or depend on forest resources will, in one way or another, feel the positive impact of this major event. Planning and holding a World Forestry Congress is a long-term investment, and the final declaration, while not a legally binding document, will guide efforts towards the vital balance of forests in development. ◆

Sixty years of collaborative partnership between FAO and IUFRO: towards the next sixty

D.K. Lee and J. Heino

Two major global forestry organizations cemented their long-term partnership at the World Forestry Congress.

At the XIII World Forestry Congress in Buenos Aires, Argentina in October 2009, the International Union of Forest Research Organizations (IUFRO) and FAO celebrated the sixtieth anniversary of their collaboration, initiated with a first Memorandum of Understanding in 1949. For 60 years, the two organizations have provided mutual support in areas such as forestry education, forest extension, incorporating science in national forest programmes, support to national forest monitoring systems, and development and implementation of guidelines for planted forests, forest protection, forest genetic resources and forest fire management. In a recorded message sent from Sweden, Börje Steenberg, FAO's first Assistant Director-General for Forestry, now 97 years old, commended the IUFRO-FAO collaboration for creating and maintaining an active interface between science and policy, that is, between research and practice.

FAO and IUFRO share the common goal of promoting conservation and sustainable use of the world's forests. IUFRO, established in 1892, provides access for its partners to a global "brain pool" of about 700 member organizations in 110 countries and more than 15 000 scientists. FAO, founded in 1945, collaborates with the scientific community through direct relations with regional, national and subnational research institutions, many of which are IUFRO members.

History of cooperation

During the Second World War, the IUFRO Secretariat was located in Sweden; its main task after the war was to re-establish international contacts.

FAO started working with international non-governmental organizations shortly after its creation in 1945. At the time, the idea of incorporating IUFRO into FAO was considered, to make it possible to formulate research aims more clearly, avoid unnecessary duplication of research projects and reduce costs.

Instead, however, the two organizations worked out an agreement in 1949 whereby IUFRO was given a special consultative status with FAO; the IUFRO Secretariat was established at FAO headquarters in Rome, but IUFRO remained independent.

In 1959, FAO asked to be released from the obligation of providing the Secretariat, but IUFRO's consultative status with FAO remained unchanged. In return, FAO was made a member of the extended IUFRO Board and maintains this status today.

Research capacity development

In 1983, IUFRO and FAO established the IUFRO Special Programme for Developing Countries (IUFRO-SPDC) to strengthen research related to forest resources in developing countries. Its first coordinator was Oscar Fugalli, who had just retired from leading FAO's Forest Management Branch. Through this programme, IUFRO provides assistance for the long-term development of the capacity of individual scientists and research institutions in developing countries. From mid-1998 to 2004, the IUFRO-SPDC Deputy Coordinator

IUFRO President Don Koo Lee (left) and then Assistant Director-General for Forestry of FAO Jan Heino sign an agreement for continued collaboration at the XIII World Forestry Congress, Buenos Aires, Argentina, October 2009

Don Koo Lee is President of the International Union of Forest Research Organizations (IUFRO), Vienna, Austria.
Jan Heino was Assistant Director-General, FAO Forestry Department, Rome, from June 2006 to December 2009.

for Africa shared office space with Forestry staff in FAO's Regional Office for Africa in Accra, Ghana.

IUFRO-SPDC offers training courses on working effectively at the interface of forest science and forest policy, and on linking science with practice in the context of international forest-related initiatives and agreements and their implementation in the context of national forest programmes. Collaborative activities of IUFRO-SPDC and FAO have included:

- the Global Forest Information Service (GFIS) Africa project, developed from a IUFRO-SPDC project and involving FAO experts;
- the Forestry Research Network for Sub-Saharan Africa (FORNESSA), developed jointly (from 2000 to 2004, the IUFRO-SPDC Deputy Coordinator for Africa was the FORNESSA Secretary);
- training workshops carried out through partnership of IUFRO-SPDC and FAO's Regional Office for Asia and the Pacific;
- forest genetic resources workshops in Asia and the Pacific, Africa and Latin America in the 1980s, with considerable follow-up action;
- financial support provided by FAO to IUFRO-SPDC's Scientist Assistance Programme (SAP).

Terminology and definitions

The organizations have long collaborated in multilingual terminology initiatives. For example, in 1971, the Joint FAO/IUFRO Committee of Experts on Forestry Bibliography and Terminology published the *Terminology of forest science, technology, practice, and products* (Multilingual Forestry Terminology Series No. 1).

In the context of the Global Forest Resources Assessment 2000, IUFRO carried out a comparative study on terminology with FAO financial support (1996–1997) to improve the comparability of national terminologies, concepts and classifications in forestry.

In 1998, FAO provided financial and technical support for a multilingual *Glossary on forest genetic resources*, developed with IUFRO's SilvaVoc Terminology Project, which recorded not only the established and widely accepted definitions of some common terms, but also the use of the terms by some professions, organizations and countries. FAO and IUFRO are continuing to explore opportunities for mutual strengthening of SilvaVoc and FAOTERM, FAO's terminology database.

In the early 2000s, FAO and IUFRO, together with the Intergovernmental Panel on Climate Change (IPCC) and the Center for International Forestry Research (CIFOR), began a process to enhance common understanding of, and possibly to harmonize, forest-related definitions that are used internationally or are being developed by various international processes and bodies, such as the environmental conventions, the United Nations Forum on Forests (UNFF), the International Tropical Timber Organization (ITTO) and FAO. Three expert meetings on harmonizing forest-related definitions for use by various stakeholders, held at FAO headquarters in Rome in 2002 and 2005, spearheaded the process. In addition, IUFRO, FAO and CIFOR organized a side event on terminology and definitions at the second session of UNFF in March 2002.

Collaborative Partnership on Forests

The Collaborative Partnership on Forests (CPF), a consortium of 14 forest-related organizations and agencies, is led by FAO, and IUFRO is an active partner. IUFRO-led CPF initiatives in which FAO participates include:

- the Global Forest Information Service (GFIS), developed under CPF since 2005. An upgraded version of the GFIS gateway was opened in January 2007, with interfaces now in English, Finnish, French, German, Russian and Spanish.
- the Global Forest Expert Panels, launched in 2007 to provide objective and independent scientific assessments of key issues to support more informed decision-making at the global level. The first GFEP report, *Adaptation of forests and people to climate change,* was released in 2009.

Other cooperative activities

FAO contributed to the elaboration of the IUFRO Position Statement on Benefits and Risks of Transgenic Plantations (1999) and subsequent work on biotechnologies in forestry.

In January 2008, FAO's Assistant Director-General for Forestry chaired an independent review initiated by the IUFRO Management Committee to assess the potential for adaptation and thematic reorientation of IUFRO's strategic priorities.

FAO and IUFRO have organized joint technical conferences. A recent example was the international conference on Adaptation of Forests and Forest Management to Changing Climate with Emphasis on Forest Health: A Review of Science, Policies and Practices, organized together with the Swedish University of Agricultural Sciences in August 2008 in Umeå, Sweden. The conference attracted more than 300 researchers, managers and decision-makers from 50 countries.

Partnering into the future

Future collaboration between IUFRO and FAO should emphasize training and networking activities, terminology issues, online learning and other forms of forestry education, engaging students and young researchers, and related financing. Joint activities such as publications, conferences, workshops and training must be continued. A mutual concern and one of the most important future tasks will be to help institutions and countries build their capacity for research and for educating young people.

With forestry today very much in the limelight, above all because of climate change challenges and growing awareness of the need to reduce deforestation, IUFRO and FAO will have an increasingly important role to play in enhancing global forestry. Their partnership will be an important element in international efforts to address these and other crucial issues affecting forests and forestry such as bioenergy, water shortage, biodiversity loss and poverty.

Dynamics of small-scale deforestation in Indonesia: examining the effects of poverty and socio-economic development

R.S. Purnamasari

An empirical analysis suggests that the rate of deforestation is actually lower in poorer regions; it increases at first with wealth, but subsequently decreases after a certain wealth level is reached.

Forest-dense areas are frequently associated with high levels of poverty (Chomitz *et al.*, 2007). The areas are often remote from markets and services and lack infrastructure. Opportunity costs of labour are low. The population also often lacks the finance necessary for investments to maintain the quality of soil or increase yields on the existing cleared land. Deforestation, including clearing for agricultural activities, is often the only option available for the livelihoods of farmers living in forested areas (Angelsen, 1999).

Does this mean that poverty in the frontier areas is the driving factor of small-scale deforestation? Should areas of greater prosperity, with better infrastructure and market integration, be expected to be associated with lower deforestation? Previous studies of poverty and deforestation have given ambiguous results. On the one hand, regional development is expected to create new opportunities for local people and improve their livelihoods, while on the other hand, poverty alleviation and improvements in well-being could also ease capital constraints and facilitate more forest conversion. Better understanding is therefore needed of the impact of regional development on rural livelihoods and the well-being of people in forest areas and, in turn, the implications for the rate of small-scale deforestation.

As in other developing countries, deforestation in Indonesia is the result of complex socio-economic processes. Poverty is widely considered to be an important underlying cause of forest conversion by small-scale farmers. This article presents the findings of a study that examined the contribution of different regional-level socio-economic and physiogeographic factors (such as altitude and slope of land) to the dynamics of small-scale deforestation in three primary forest areas in Indonesia – Kalimantan, Sumatra and Sulawesi – which together constitute about 60 percent of Indonesia's total forest cover.

Small-scale deforestation in East Kalimantan, Indonesia

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The analysis was conducted at the district level. A temporal and spatial econometrics approach was used to investigate the extent to which various facets of poverty and regional development motivated people to clear forest land in 124 districts over an 18-year period (1985–2003). For the purpose of the study, deforestation refers to small-scale district-level deforestation, unless otherwise indicated.

CONCEPTUAL FRAMEWORK

The theoretical framework employed in this study is a dynamic optimization model of irreversible land-use change as in Kerr, Pfaff and Sanchez (2002) and Vance and Geoghegan (2002). The framework models the decision of an individual land user about whether or not to convert a patch of land from its forested state to agricultural use in response to changing economic conditions over space and time, given location-specific factors affecting returns from the land. The assumption about the irreversibility of land-use change is broadly consistent with the reality of tropical deforestation today, as most cleared land is not returned to its previous forested state (Kerr *et al.*, 2004; Vance and Geoghegan, 2002). The impact of expected returns from conversion to agriculture is seen clearly in the case of the impact of agricultural commodity prices on deforestation. Even when the increase in commodity price is only temporary, it tends to raise expectations about future prices, increasing the expected profitability from land clearance and conversion to agriculture (Angelsen, 1995; Sunderlin *et al.*, 2000). Thus, even if prices subsequently fall to a level insufficient to stimulate clearing, the price fall might not lead to abandonment and hence reforestation on recently cleared land.

This model provides some key insights into the process of irreversible land conversion. However, it leaves out some key factors that can influence the decision-making of farmers living on forest frontiers. In particular, the nature of property rights and changes in traditional community ownership systems produce incentives to induce earlier land conversion. Nevertheless, in Indonesia property rights over forest land are not well defined in practice, although most forest land is formally controlled by the State. In most frontier areas, forests are generally regarded by communities as an open access resource with free entry and no restrictions on land use. This means that, in general, an individual farmer can exercise control over the land-use options for any selected patch of forest land and decide whether to keep the land in its current forest state or convert it to agricultural production. Therefore, while the loss of property rights to a parcel of forested land is not directly measured and incorporated in the model, it can be considered and included as one of the potential costs of allowing land to remain in its traditional forested state.

POVERTY CONTEXT

Some have argued that poor people clear forests and cultivate new lands in order to maintain yields because they cannot finance the necessary investments to preserve soil quality of the existing cultivated land (Zwane, 2007). Poor people tend to be clustered in frontier areas with inadequate access to market institutions (which would limit transaction costs), transport infrastructure, means and services. In this situation, labour-intensive land clearing is more profitable than other activities for these poor people (Deininger and Minten, 1996; Vedeld *et al.*, 2004). In other cases, the expansion of cultivated areas for crop diversification is a coping strategy for poor people who are vulnerable to price volatility and other types of uncertainty (Sunderlin, et al., 2000). On the other hand, poverty may reduce deforestation because of the lack of capital necessary to clear land (Wibowo and Byron, 1999).

Individual farmers make land-use decisions taking into account expected costs and revenues associated with each alternative. The decision is also affected by farmers' resource constraints. Thus, other things being equal, one can expect that if expected returns from agriculture increase, then deforestation rates are likely to increase. If forest conversion is costly and/or there is a long gestation period for positive returns from agriculture, then poorer, liquidity-constrained farmers are less likely to shift to increased land-clearing activities.

Clearly, there is no simple theoretical expectation as to the impact of poverty on land-use activities. The signs and relative magnitudes of the different factors associated with poverty need to be investigated empirically.

EMPIRICAL ANALYSIS

A population-averaged panel model was used to estimate the annual deforestation rate (the dependent variable) as a function of relative returns from forest conversion to agriculture and factors affecting them, including poverty and development (the explanatory variables) (Table). Of 142 total districts in the study region, 18 were excluded from the analysis because they lacked either forest area or the data needed for the estimations.

The technical details are omitted from this article but are available from the author.

Dependent variable: deforestation rate

Data on forest area and forest area change were derived from geographic information system (GIS) analysis of satellite images of land cover observed at five points in time: 1985, 1990, 1996, 2000 and 2003. Since Indonesia does not have nationwide integrated data on land cover, forest cover data are derived from land cover maps from several sources: the Regional Physical Planning Programme for Transmigration (RePPProT) for 1985 maps, the National Forest Inventory project of the Ministry of Forestry for

Summary statistics of the variables

Variable	No. of observations	Mean	Standard deviation	Minimum	Maximum
Annual deforestation rate (%)[a]	496	0.0475	0.1145	0.0001	1.6198
1985–1990 (%)	124	0.0181	0.0441	0.0001	0.4294
1990–1996 (%)	124	0.0062	0.0186	0.0002	0.1927
1996–2000 (%)	124	0.0237	0.0622	0.0003	0.6464
2000–2003 (%)	124	0.1420	0.1856	0.0001	1.6198
Wealth index	496	25.1494	2.9920	18.0000	39.0000
1986	124	24.1925	2.9690	19.2553	39.0000
1990	124	24.4692	3.0081	19.9143	37.0000
1996	124	25.8967	2.7450	21.1596	34.1667
2000	124	26.0393	2.8067	18.0000	34.6667
Return proxies					
Industrial crops suitable (% forests at risk)	496	23.2635	28.2052	0.0000	100.0000
Arable suitable (% forests at risk)	496	13.2830	20.0333	0.0000	100.0000
Distance to province capital (km)	496	127.0543	105.4845	0.0000	752.4142
River density (km/km^2)	496	0.2887	0.1549	0.0356	0.6346
Proxies for regional developments					
Per capita regional GDP (million Rp)	496	1.4606	1.1043	0.4055	9.9305
Industrial workers – proportion of population (per 1 000 persons)	496	7.0948	12.4597	0.0000	141.2487
(Lagged) Population density (persons/km^2)	372	258.3463	682.2017	2.0130	5760.0470
(Lagged) Annual HPH deforestation rate	372	0.0687	0.1802	0.0000	1.0000
(Lagged) Cumulative deforestation (% total forests period 1)	372	0.1355	0.2866	0.0000	3.2651
Neighbouring district variables (average)					
Per capita regional GDP (million Rp)	496	1.2874	0.7547	0.0000	5.8792
Industrial workers – proportion of population (per 1 000 persons)	496	6.2611	6.5602	0.0000	42.9607

[a] For this table the deforestation rates are presented in % (the actual values and their standard deviations are multiplied by 100).

1990 maps, and the Planning Department of the Ministry of Forestry for 1996/1997, 2000 and 2003 maps, including maps of forests allocated for logging concession (referred to as *hak pengusahaan hutan* [HPH]) from 1980 to 2000. Although the data are the best available, they vary in terms of scale and precision and possibly contain inconsistencies, and they should be interpreted with caution (Chomitz *et al.*, 2007; FWI and GFW, 2002).

All series of the land cover maps were first regrouped into two broad categories – forests and non-forests – so they could be integrated across time. The forest and non-forest maps were then overlayed with HPH maps to exclude the large-scale concession areas from the forest area considered to be potentially clearable by small-scale farmers. Formally, most forests in Indonesia are State owned, although in practice they are open access. Nevertheless, small-scale deforestation activity normally only takes place in areas not designated for HPH, and for this reason the HPH areas are excluded from the forest areas that can potentially be cleared by small-scale farmers. The new maps were then overlaid with the 1996 district boundary maps to generate data sets on forest area by district for each point in time.

Small-scale deforestation is defined here as a cleared patch in the range of 0.05 to 10 ha. Dewi *et al.* (2002) assert, and are supported by some field observations, that small patches of deforestation are mostly associated with smallholders' activities in agriculture. The small-scale deforested area for the district level is obtained by aggregating all small-scale cleared patches in the whole district.

The dependent variable, the annual deforestation rate (in percentage), is defined as the area deforested between periods divided by the total forest area in the initial period of interest. The deforestation rates were generated for the periods 1985–1990, 1990–1996, 1996–2000 and 2000–2003. Because the time intervals are different across the periods, annual deforestation rates were used for the estimation, assuming that this annual rate was the same in each year within the period. Annual deforestation rates were calculated using the FAO formula for calculating the annual rate of forest change, based on compound interest principles (FAO, 1995).

Explanatory variables

To match with the dates of the dependent variable, the study used data dates of 1986, 1990, 1996 and 2000 for the explanatory variables.

Poverty measure. The use of poverty as an explanatory factor in a deforestation model can lead to an endogeneity prob-

lem, resulting from the possibility of reverse causality: poverty is normally defined as a lack of income, and that income is a function of deforestation activities. Therefore, per capita income is not used as a poverty measure in the estimation. Instead, poverty incidence was assessed using a wealth index based on infrastructure and facilities, natural resources and socio-economic conditions at the district level. A regional wealth index was generated from the National Village Potential Survey (PODES) data for 1986, 1990, 1996 and 2000 from Badan Pusat Statistik (Statistics Indonesia).

Proxies for returns to clearing. Since direct information on agricultural and forest-product returns which is consistent across different products and over time is difficult to find, proxies were used.

To capture unobserved agricultural productivity, two district land suitability measures, derived from RePPProT maps, were used: the proportion of the district forested area at the beginning of each period that was suitable for food crops (arable suitable) and for tree crops such as cocoa, palm oil, rubber and coffee (industrial crops suitable). The land suitability assessments, which were based on topography, climate, water and soil characteristics, indicate the most beneficial or productive use of the land. River density and distance between district and provincial capital cities were used as proxies for transport costs and access to markets.

Proxies for regional development. Although the effect of development is already indirectly taken into account through several factors in the wealth index measurement, the study also includes some direct measures for district development, to examine better the direct effect of the development process on relative returns and hence clearing patterns.

The first measure of district development is per capita non-oil regional gross domestic product (regional GDP) (Statistics Indonesia, 2007) . Since this measure is based on the market value of all final goods and services in the region over time, regional GDP represents regional economic and general development, including infrastructure and institutional development.

Industrialization is expected to improve the social and economic welfare condition of the regions and also to offer more economic opportunities to people – an important factor affecting deforestation rates (Angelsen, 1999; Godoy *et al.*, 1996; Shively and Pagiola, 2004). Thus, in addition to regional GDP, the proportion of the population engaged in the district's industries was included as a proxy for off-farm employment opportunities.

The impact of population density on deforestation has been a subject of controversy. Several studies of deforestation have included population density in the analysis, but no systematic relationship has been seen (e.g. Cropper, Griffiths and Mani, 1999; Pfaff, 1999; Uusivuori, Lehto and Palo, 2002). To investigate the impact of population on the pace of deforestation, population density was included in the study as one of the explanatory variables.

In Indonesia, HPH activities could stimulate local development in the surrounding areas, which in turn could either stimulate deforestation in the area (Angelsen, 1995) or stimulate off-farm economic activities which could cause a shift away from clearing (Levang, 2002). To capture these potential effects, the estimations include the annual HPH deforestation rate.

The study also included a district's cumulative deforestation as another proxy for local development.

Land-use patterns in a given district are possibly not only a function of variables for that district, but may also reflect the characteristics of neighbouring districts as a result of shared constraints and opportunities, networks or externalities. The study therefore included variables reflecting economic development, off-farm employment opportunities and population density in neighbouring districts.

RESULTS AND DISCUSSION

Poverty and deforestation

The estimation results show a significant impact of poverty on deforestation. The observed relationship between poverty and deforestation follows an inverted U-shape which implies that deforestation is lower in the poorest districts. One possible explanation is that people in severe poverty lack the means to convert land to agricultural cultivation and prefer to have income that can be generated quickly – in the form of cash or subsistence – such as that obtained from forest products extraction. This argument is consistent with a study by Wibowo and Byron (1999) showing that poverty conditions prevented deforestation in Kerinci-Seblat National Park, Indonesia. As the people in an area become wealthier, deforestation rates increase, possibly because the people now can afford to put more land into production. The increase in deforestation, however, is at a decreasing rate (i.e. the increment in the deforestation rate decreases as wealth increases), which suggests that after a certain wealth level, possibly when people have the required capital inputs for agricultural intensification or better access to other income-generating options, there is less demand for further agricultural expansion.

The estimated relationship between poverty and the deforestation rate could be graphed (Figure) with the predicted values of the deforestation rates estimated by varying the value of the district wealth index but keeping the values of the other variables constant at their mean values. As shown in the Figure, the deforestation rate reaches a maximum at about the ninetieth percentile of the

Inverted U-shaped relationship between poverty and deforestation

distribution of the wealth index, indicating that the deforestation rates of most districts are still increasing.

Since wealth reflects development, these results suggest that the impact of development on deforestation varies depending on the current state of wealth. In the study sites, from 1985 to 2000 the per capita regional GDP grew at an average rate of 3.7 percent per year. During this time, the district wealth index increased on average by 7.9 percent and the deforestation rate increased from 0.018 to 0.14 percent per year. The annual deforestation rate for 2000 to 2015, predicted using the same growth rate of the per capita regional GDP and the district wealth index from 1985 to 2000 while keeping the other variables constant, shows a decrease to 0.01 percent.

Returns and development proxies

In line with expectations, a higher proportion of available forest land suitable for tree crops leads to significantly higher deforestation. On average, a 1 percent increase in the proportion of the district forested area that is suitable for industrial or estate crops will increase the deforestation rate by 0.48 percent. However, the estimation showed the proportion of forest land suitable for wetland and dryland agriculture to be insignificant. This indicates that areas suitable for tree crops, instead of food crops, are of greater interest to small-scale farmers in frontier areas. This is consistent with a previous finding that tree-crop shifting cultivation, rather than staple-crop shifting cultivation, plays the largest role in small-scale deforestation in Indonesia (Chomitz and Griffiths, 1996). Sunderlin *et al.* (2000) noted that land clearing for tree crops increased as a result of the severe economic crisis that hit the country in 1997.

The significant coefficients of river density and distance confirm the important role of transportation costs and access to markets in the deforestation process. The negative coefficient of river density suggests that in the study regions the net impact of better transport facilities is to reduce deforestation. The positive sign of the distance variable suggests that greater distance to big cities increases deforestation. The estimate shows that the deforestation rate increases, on average, by 14.3 percent for each 100 km of distance from a provincial capital. However, the negative sign of this variable when it is interacted with a time variable suggests that this effect diminishes with time, perhaps because of improved transport infrastructure and vehicles over time. Overall, isolated areas with limited transportation facilities and poor access to markets experience higher deforestation.

The results show that the per capita regional GDP variable is not significant in the model. One explanation could be that within-region disparities are still a serious problem in Indonesia. That is, development processes and their impacts might not be equally experienced throughout the district and hence the district-level variables do not reflect conditions in frontier regions. Alternatively, it could be that there are offsetting effects between development factors that actually reduce small-scale deforestation rates (e.g. improved legal systems inducing productive investments in the existing cleared land) and factors that accelerate deforestation (e.g. new concessionaires' roads which stimulate land clearing for shifting cultivation).

Contrary to expectations, the variable reflecting the number of industrial workers was found to have a positive and significant correlation with deforestation. This may reflect limited opportunities for local people, who are generally involved in small-scale land clearing, to work in industry, as most of the new employment opportunities resulting from growth in industry or concessions are often taken by outsiders who migrate to the area. Limited skills and fears about the reliability of local workers are often given as the main reasons firms are reluctant to hire them (Levang, 2002). Further, new migrants in the area increase demand for food and other agricultural products which can induce the farmers at the forest frontier to increase their agricultural production by expanding agricultural land.

The insignificant effect of population density on deforestation is consistent

with the argument that, at the regional level, population is potentially determined by other factors that influence economic activity, such as off-farm activities and infrastructure availability. Thus, population *per se* is unlikely to be the underlying cause of deforestation (Kaimowitz and Angelsen, 1998).

The insignificance of HPH activities may contradict the common expectation of a positive correlation between logging concessions and small-scale deforestation. However, previous studies on the impact of logging intensity on small-scale deforestation focused on small-scale farming in abandoned logging plots, rather than on farmers' new clearing of forested land (Geist and Lambin, 2001).

Results show that, when controlled for other influences, the percentage of total forest area cleared in the preceding period has statistically insignificant effects on the deforestation rate. This could be because the level of local development has already been controlled for by the variables representing the proportion of forest area suitable for farming and tree crops available for clearing in each period in the specifications. Alternatively, as was the case for the per capita regional GDP variable, it may be that these lagged variables are insignificant because they are at the district rather than local, frontier level.

The regional GDP and number of industrial workers in neighbouring areas appear to have insignificant effects on a district's deforestation, suggesting that spatial interactions are not very important.

SUMMARY AND CONCLUSIONS

Unlike most previous studies on the deforestation-poverty link, the empirical analysis in this study utilizes a data set combining spatial data on forest cover and physiogeographic factors from satellite imagery with socio-economic panel data from several national surveys. The poverty measure incorporates both human well-being and location welfare components, allowing for a comprehensive examination of poverty effects on the pace of deforestation. With data spanning more than 18 years – presented at five points in time – and 124 districts, the study is one of the most comprehensive examinations of deforestation by small-scale farmers undertaken for Indonesia.

The empirical results show an inverted U-shaped relationship between district wealth and deforestation where the rate of deforestation increases with wealth, but at a decreasing rate. Poorer districts – those with a higher percentage of poor people – tend to deforest less. Deforestation increases until a certain wealth level is reached and then declines. However, it starts to decrease only at the top decile of the current district wealth distribution.

In the Indonesian context it is the land that is most suitable for tree crops that is most vulnerable to deforestation. When the land is suitable for tree crops, the incentives are obviously higher for forests to be cleared for establishment of cash crops such as oil palm. This has been a factor driving a significant part of land conversion through deforestation in the past, and also has implications for the future.

The findings of this study suggest that the impact of development on deforestation depends on the current state of wealth and the level of development in the frontier regions. A worrying feature of these findings is that policies aimed at stimulating regional development may stimulate further deforestation. For most districts, increased wealth, other things being equal, will initially increase deforestation.

Counterbalancing this concern, however, is the finding that lower transport costs and better access to markets reduce deforestation. The study also found that greater off-farm employment opportunities were associated with less forest clearing. Thus, the challenge for districts will be to manage development in such a way as to ensure good and equitable access to labour markets and remunerative off-farm employment opportunities for rural people. ◆

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Uncertain coexistence: jaguars and communities in montane forests of Mexico

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A study of the potential for community conservation of jaguars in the Sierra Norte of Oaxaca, Mexico.

In Mexico, the conservation of the jaguar (*Panthera onca*) has mainly focused on large public protected areas. However, existing protected areas are not always effective for species and habitat conservation, and Mexico's widespread common property land tenure limits opportunities for declaring new areas. Thus, protection for the jaguar, as for many other forms of wildlife, needs to be focused on larger landscapes where high biodiversity coexists with human activities. In recent years, there has been a significant movement towards community-based biodiversity conservation, including the establishment of indigenous/community conserved areas (a category established by the International Union for Conservation of Nature and Natural Resources [IUCN] in 2004 and recognized legally in Mexico since 2008).

Jaguar conservation issues were examined in four communities with over 32 000 ha of territory in the Chinantla ethnic region of the Sierra Norte in the state of Oaxaca, which is dominated by montane tropical forests. The region's biodiversity is among the highest in Mexico, and 95 percent of the territory is under common property governance regimes, largely by indigenous peoples. Because "negative attitudes and perceptions by humans towards jaguars are clearly the greatest imminent threat to the species' survival" (Rabinowitz, 2005), the study combined both ecological and social methods.

Camera-trap surveys in the region established the presence of at least two jaguars and 10 species of prey animals (Table 1). Human-jaguar interactions were explored through semi-structured and structured interviews in over 100 households in the four communities during 2007/08. Interviewees were legal community members aged 17 to 93 years old. Most (152 individuals) were crop farmers; 18 of these also engaged in small-scale cattle ranching. Only three were women, since few women are legal community members under Mexico's agrarian laws. Legal community members under the age of 60 are obligated to participate actively in decisions about natural resources management, land use and conservation, among other community governance issues. The interviews explored knowledge about jaguars, prey, wildlife and hunting, jaguars in traditional culture, livestock predation and conservation.

A total of 103 jaguar sightings were documented by 67 individuals – 83 since 1990 and 60 since 1999. The most common prey species mentioned were coati, armadillo, red brocket deer and peccary, all considered to be abundant both in forests and in agricultural areas (where they are considered pests). Notably, 79 percent of the interviewees valued jaguars for biological control of these pest animals.

Most farmers expressed positive (68 percent) or mixed (20 percent) attitudes towards

Jaguar sighted by a camera trap

J.J. FIGEL

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TABLE 1. Potential jaguar prey species photographed by camera traps in the study communities

Spanish common name	English common name	Scientific name	National endangered category
Armadillo	Armadillo	*Dasypus novemcinctus*	Yes: low risk
Hocofaisán	Great curasow	*Crax rubra*	Yes: threatened
Mapache	Racoon	*Procyon lotor*	No
Mazate	Brocket deer	*Mazama americana*	Yes: low risk, use restricted
Pecari	Collared peccary	*Tayassu tajacu*	Yes: low risk
Serete	Central American agouti	*Dasyprocta mexicana*	Yes: extinction risk
Tejón	Coati	*Nasua narica*	Yes: low risk, use restricted
Tepezcuintle	Paca	*Agouti paca*	Yes: low risk
Tlacuache	Possum	*Didelphis marsupialis*	No
Venado	Deer	*Odocoileus virginianus*	No

jaguars. The 12 percent that expressed negative attitudes were those with cattle: As in most regions, predation on livestock and domestic animals was the principal source of conflict between humans and jaguars (Table 2). Jaguar predation was commonly mentioned as a reason for a decline in the number of cattle in the four communities from a peak of around 300 in the 1980s to about half that in 2007/08. Lethal control of jaguars by humans had occasionally occurred. Respondents reported the killing of seven jaguars and one puma in past years, nearly all in retaliation for livestock predation.

The study confirmed that the Chinantec people have a deeply rooted cultural connection with jaguars, particularly manifested in a belief in *nahuales*, human beings who can change themselves into jaguars. Nearly 50 percent of the respondents said that they had heard stories about jaguars from parents or grandparents, and 63 percent – irrespective of age – said that they believed in *nahuales*.

The interviews suggested that a new awareness is emerging which may favour jaguar conservation. Interest in agriculture and cattle ranching has declined with outmigration, and the communities are attempting to turn to ecotourism and other conservation-oriented activities to raise income. Today the jaguar image is used as an icon for recent conservation-related institutions and cultural practices. In 2005 the communities declared community conserved areas, where hunting is banned, in nearly 80 percent of their territories; they also approved new community statutes which ban the hunting of red brocket deer as well as other jaguar prey species unless they are pests in agricultural areas. The statutes also ban the killing of jaguars but do not specifically prohibit retaliation killings. Most respondents (92.5 percent) were aware of the community statutes, and most felt that they received benefits from conservation, mostly from a programme for payments for hydrological services administered by the Mexican Government.

E. DURÁN

Today the jaguar image is used as an icon in the region – as seen in this football shirt worn by a Chinantec villager

TABLE 2. Attacks on livestock and other domestic animals attributed to jaguars in four study communities during the past ten years

Animals attacked	Events reported[a]	Deaths reported	Events with jaguar sighting[b]	Deaths with jaguar sighting
Calves, cows	10	17	2	6
Chickens, turkeys	4	24	1	1
Dogs	10	16	3	6
Mules, donkeys, horses	4	5	0	0
Sheep	4	11	2	4
Total	**32**	**73**	**8**	**17**

[a] Reported by 28 farmers.
[b] Reported by 7 farmers.


E. DURÁN

Communities are turning to ecotourism to raise income, building on the jaguar as a conservation image (jaguar sculpture near an ecotourism cottage)

These results suggest the possibility of positive prospects for conservation of large charismatic carnivores such as jaguars in community-dominated landscapes beyond protected areas. Jaguars still remain vulnerable to retaliation killings by those whose livelihoods are most directly affected; but the potential of alternative economic activities may further diminish the economic importance of cattle. Future research will need to establish the connectivity of this region with other adjacent regions which may also provide viable jaguar habitat, and the viability of economic alternatives to cattle for the few people who have them.

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Large-scale forests for bioenergy: land-use, economic and environmental implications

M. Jack and P. Hall

An analysis of national-level impacts of plantation forestry for energy production in New Zealand – a useful tool for strategic decision-making.

Concerns about climate change and energy security have driven many countries to reconsider their renewable energy options and strategies. Energy from biomass is expected to play an important role and has received significant attention in recent years. While its potential positive contributions are well recognized, development of biofuels may also have negative impacts. Assessment of a country's bioenergy options should thus include analysis of:

- potential biomass resources;
- consumer energy demand (given other potential renewable energy options);
- available technologies for converting biomass into consumer energy;
- economic cost;
- potential reduction in greenhouse gases;
- impacts of land-use change;
- competition with food production.

An assessment of this type has been carried out in New Zealand. It highlighted the country's potential for producing bioenergy from large-scale forestry and then examined the consequences this would have for land use, the economy and the environment. This article summarizes the results of the study. A longer report (Hall and Jack, 2009) provides more detailed discussion of the methodology and assumptions behind the work. Although the study was specific to New Zealand, it raises pertinent questions that other countries may consider in analysing their bioenergy options.

While socio-political aspects are also key components to such decision-making, they were outside the scope of this study and not addressed in detail.

The development of a large-scale forestry resource on marginal land represents New Zealand's greatest opportunity for bioenergy

SCION

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ANALYSIS OF BIOENERGY OPTIONS

The above parameters were assessed through:

- a situation analysis, examining current biomass residual resources, the potential of purpose-grown options, and the status of existing biomass-to-consumer energy technologies (Hall and Gifford, 2007);
- a pathways analysis, examining economic costs and environmental impacts (through life-cycle assessment) of nationally relevant biomass-to-consumer energy conversion pathways (Hall and Jack, 2008).

The study determined that the main role of bioenergy in New Zealand is likely to be for heat and liquid transport fuels, because of the significant potential of other renewable resources for electricity generation. The assessment also identified the development of a large-scale forestry resource utilizing marginal land as the most significant opportunity for bioenergy in New Zealand from the following perspectives.

- ***Potential scale of energy supply.*** New Zealand has sufficient low- to medium-productivity grazing land – over 60 percent (9.3 million hectares) of available productive land – to establish a plantation forest resource that, by 2040, would be of sufficient scale to supply all of the country's demand for liquid fuels. In contrast, only about 26 percent (2.4 million hectares) of productive land in New Zealand is suitable for agricultural crops; using all this area for crops for first-generation liquid biofuel would provide insufficient liquid fuels to meet the national demand and would be detrimental to food crop production and agricultural exports.
- ***Greenhouse gas reductions.*** Life-cycle assessment of the full production chain showed that producing lignocellulosic biofuel from plantation forestry feedstock would have much lower environmental impact than producing first-generation biofuel from oil and starch crops, mainly because of the less intensive farming practices per unit of biomass.
- ***Technological maturity and cost.*** Technology for converting lignocellulosic biomass to liquid transport fuels is progressing rapidly towards commercial viability (Sims *et al.*, 2008).

ASSESSMENT OF LARGE-SCALE FORESTRY FOR BIOMASS PRODUCTION

The authors assessed the impacts of displacing agriculture (mainly low-productivity grazing) with forestry on hilly land for four large-scale afforestation scenarios (Table 1). In these scenarios, potential land for afforestation was selected from a Geographic Information Systems land-use class database. The scenarios differ in land-use class, slope, altitude and current land use. It was assumed that lowest-value land would be used first (Scenario 1) and that subsequent scenarios would embrace land of progressively increasing value. The scenarios presume the use of scrub, idle, marginal and low-to-moderate productivity grazing land as the resource area and explicitly exclude conservation and arable land.

The potential biomass productivity for the scenarios was calculated based on soil and climate (Table 2) and the economic cost of biomass production (Table 3), assuming some flexibility between energy production and other end uses (e.g. timber or carbon credits), which mitigates risk for the forest owner.

Potential environmental impacts

All scenarios were associated with significant greenhouse gas emission reductions (estimated using Intergovernmental Panel on Climate Change [IPCC] methodologies), both from displacement of fossil fuel and from the change in land use from agriculture (which accounts for about half of New Zealand's emissions) to forestry (Table 4). The scenarios were associated with increased carbon stocks, because for a sustainably managed 25-year rotation forest, only 4 percent is harvested per year (Table 4). Emission reductions were lower in Scenarios 1 and 2 because of the lower-intensity land use that is displaced in these scenarios.

Because of reduced levels of pastoral production (Table 5), the scenarios also showed benefits in a number of areas of environmental concern in New Zealand including erosion, sedimentation and nutrient leaching into waterways (estimated using a nutrient model and a spatial erosion model) (Table 4).

Largely positive biodiversity impacts were also found, in improved species richness of insects, plants and native birds in comparison with pasture and exotic shrub lands. However, quantification of these benefits requires further research. Afforestation of land that was not historically forested may not be desirable from a biodiversity perspective as it reduces native grassland habitats.

The analysis showed that in some areas – those with low rainfall and high existing water allocations – large-scale afforestation could have negative impacts on water availability and its suitability would thus be questionable.

Potential for competition from alternative land uses

The current return for the land under the scenarios was assessed to determine the economic viability of forestry for biomass for energy production (Todd, Zhang and Kerr, 2009). Because of the greenhouse gas emissions associated with agriculture, the return from the land depends on the price of carbon (Table 6) and the competitiveness of biomass for fuel compared with current land use depends on the price of oil. Based on the biofuel production costs assumed in the study (Table 7), bioenergy from forestry is a more profitable option; it can provide

TABLE 1. Afforestation scenarios derived using criteria based on land-use class, slope, altitude and current land use (area from minor contributing land uses, such as deer farming, not included)

Scenario	Total area *('000 ha)*	Area from scrubland *('000 ha)*	Area of sheep and beef pasture *('000 ha)*
1	831	0	533
2	1 856	51	1 619
3	3 475	69	3 160
4	4 927	198	4 412

Note: New Zealand's current plantation estate is 1.8 million hectares.

TABLE 2. Total sustainably extractable biomass and corresponding energy potential of each afforestation scenario to meet consumer energy demand

Scenario	Total extractable biomass *(million m^3/year)*	% of current consumer energy demand[a]
1	23	68% of heat, or 20% of liquid transport fuel
2	74	100% of heat and 42% of liquid transport fuel, or 72% of liquid transport fuel, or 73% of electricity
3	127	100% of heat and 100% of liquid transport fuel
4	169	100% of heat and 100% of liquid transport fuel and 85% of electricity

[a] In this table "heat" refers to all industrial and domestic heat, and "electricity" is large-scale centralized electricity generation.

TABLE 3. Range of biomass yields and production costs[a]

Scenario	Biomass yield *(m^3/ha)*	Costs per cubic metre[b]									
		Growing[c]		Roads		Harvest		Transport[d]		Total	
		NZ$	US$	NZ$	US$	NZ$	US$	NZ$	US$	NZ$	US$
1	640–850	21–28	15–20	4–6	3–4	34–38	24–27	13–15	9–11	72–87	50–70
2	940–1 240	14–19	10–13	3–4	2–3	34–38	24–27	13–15	9–11	64–76	45–53
3	940–1 240	14–19	10–13	3–4	2–3	34–38	24–27	13–15	9–11	64–76	45–53
4	910–1 200	15–20	11–14	3–4	2–3	34–38	24–27	13–15	9–11	65–77	46–54

[a] The range is based on a potential growth gain of 32% due to alternative species, tree breeding or genetic modification and potential improvements in transport and harvesting efficiency.
[b] All costs were determined under local conditions and converted to US$ assuming the exchange rate NZ$1 = US$0.7.
[c] Includes land rental, land preparation, planting, weed control and forest maintenance (discount rate, 6%).
[d] 75 km.

TABLE 4. Percentage change in key environmental parameters relevant to New Zealand

Scenario	Reduction in greenhouse gas emissions[a] *(%)*	Carbon stocks *(million tonnes CO_2 equivalent)*	Reduction in nitrogen leaching[b] *(%)*	Reduction in erosion[c] *(%)*	Reduction in available water[d] *(%)*
1	6	208	0.3	1	1
2	20	647	3	8	3
3	37	1 183	8	17	5
4	48	2 034	12	20	7

[a] Compared to New Zealand's total emissions in 2006.
[b] Relative to current levels. Note that leaching rates can remain high for several years if the soil already contains a large amount of surplus nitrogen.
[c] Relative to current levels.
[d] As percentage of annual water balance.

TABLE 5. Reduction in livestock numbers (%)

Scenario	Beef cattle	Dairy cattle	Deer	Sheep
1	3.0	0.1	2.0	2.8
2	15.0	0.8	11.1	15.1
3	33.3	2.0	14.9	32.1
4	46.8	3.5	27.2	42.0

TABLE 6. Pre-afforestation average annual profit (earnings before interest and taxes) on land selected for bioenergy[a]

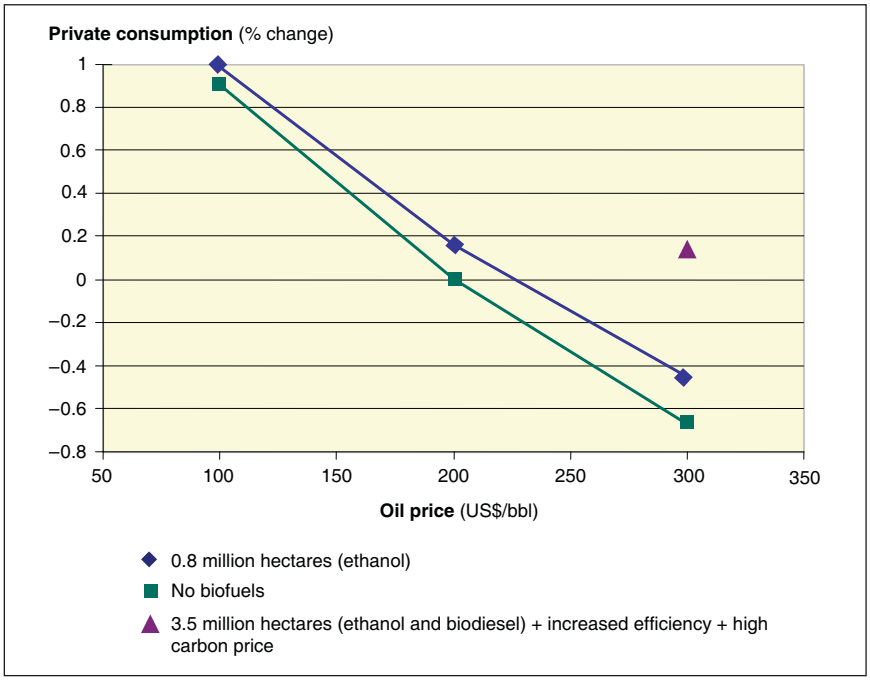
Scenario	Without carbon price		With carbon price[b]	
	NZ$/ha	US$/ha	NZ$/ha	US$/ha
1	94	66	60	42
2	144	101	100	70
3	162	113	114	80
4	160	112	108	76

[a] All prices were determined under local conditions and converted to US$ assuming the exchange rate NZ$1 = US$0.7.
[b] Assumes a carbon price of NZ$25 (US$17.5) per tonne of CO_2 equivalent.

TABLE 7. Assumed costs of biofuel production (per litre)[a]

Process	Bioethanol[b]		Fischer-Tropsch biodiesel[c]	
	NZ$	US$	NZ$	US$
Feedstock production[d]	0.61	0.43	0.89	0.62
Conversion[e]	1.12	0.78	0.70	0.49
Total	**1.73**	**1.21**	**1.59**	**1.11**

[a] All costs were determined under local conditions and converted to US$ assuming the exchange rate NZ$1 = US$0.7.
[b] Assumes a yield of 140 litres/m^3. Energy content of a litre of ethanol is 0.67 litres of petrol, meaning that total production costs are NZ$2.58 (US$1.81) per litre of petrol equivalent.
[c] Assumes a yield of 95 litres/m^3. Energy content of Fischer-Tropsch biodiesel is assumed to be the same as fossil diesel.
[d] This value represents the upper bound of the values shown in Table 3.
[e] See Hall and Jack, 2009 for more details on conversion cost assumptions.



Economic impact of changes in oil prices in New Zealand, with and without biofuels and other measures to mitigate climate change

a return of more than NZ$200 (US$140) per hectare when the oil price reaches US$180 to $250 per barrel (depending on the exchange rate). (Note that the oil price was US$147 per barrel in July 2008.) However, this economic driver may not be sufficient to lead to land-use change, as historically farmers have tended to stay with sheep and cattle farming even when its profitability is low. More research is required to understand the social drivers, which were not considered in this study.

Macroeconomic impact

A general equilibrium model was used to estimate the consequences of using the nation's land resources to produce biomass for fuel instead of other goods and services that are exported in exchange for oil (Stroombergen, 2009). Several economic scenarios based on assumed production costs, oil prices and carbon stocks were compared with a business-as-usual picture of the economy in 2050.

Currently, New Zealand obtains half its consumer energy and 93 percent of its transport fuels from imported oil, and its oil consumption per unit of gross domestic product (GDP) is the third highest in the world (Delbruck, 2005). A large part of the export earnings used to purchase this oil comes from agricultural production. Therefore, a rise in oil prices relative to agricultural goods would have detrimental effects on terms of trade and consequently the economy as a whole.

This trade also has a major impact on domestic greenhouse gas emissions, as it includes both the direct carbon emissions from oil consumption and the indirect greenhouse gas emissions from agricultural activities used to pay for imported oil. If carbon pricing in New Zealand includes all sectors of the economy in the future (which is likely under the New Zealand Emissions Trading Scheme), then this trade will magnify the potential impact of emission controls on the economy. Thus, domestic production of low-carbon biofuels could reduce the economic impact of both rising oil prices and stricter emission controls in the future.

The Figure demonstrates how biofuels could reduce the economic impact of higher oil prices in the future. The points show the impact of changes in oil prices and biofuel production on pri-

Residues from timber production for use in bioenergy: multipurpose forests producing a range of products including timber and biomass for fuel are likely to be the most economically viable option

SCION

vate consumption (a measure of economic welfare) compared with a baseline scenario for 2050 that includes an oil price of US$200 per barrel, no biofuels and an economy similar in structure to today's.

With no biofuels, an increase in oil price to US$300 per barrel would reduce private consumption by about 0.7 percent (compared with the baseline) because of the reduction in terms of trade. With 0.8 million hectares used for ethanol production, oil imports would be 15 percent less and the same oil price increase would result in a smaller decline in private consumption (of about 0.45 percent). With an even greater expansion of biofuels (3.5 million hectares used, reducing oil imports by 63 percent), plus efficiency gains and a high carbon price, the macroeconomic impact of an increase in oil price to US$300 per barrel would be more than completely mitigated.

Multipurpose forests producing a range of products including timber and biomass for fuel are likely to be the most economically viable source of biofuels, and the economic benefits of biofuels are greatest when they are competitive with fossil fuels. However, as this example shows, long-term energy policies should take into account that biofuels may result in macroeconomic benefits in the future even though their current production costs are higher than the costs of imported fossil fuels.

CONCLUSIONS

A key finding of this assessment is that in New Zealand, growing large-scale forest plantations for bioenergy on low-productivity agricultural land can have a significant impact on greenhouse gas emissions through both land-use change from agriculture to forestry and displacement of fossil fuels. It can also have other environmental benefits in terms of improved water quality and erosion control in comparison with agriculture. This is a case where land-use change would thus have positive environmental impacts. These results would most likely hold for other countries where forests can be grown with low inputs on low-productivity agricultural land.

This type of assessment of land-use, environmental and economic impacts of bioenergy at the national level can help governments make strategic decisions about large-scale bioenergy opportunities as part of national energy supply. The approach can also help to identify national and regional issues that need to be addressed to realize the benefits of these opportunities. ◆

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Valuation of forest ecosystem goods and services and forest natural capital of the Beijing municipality, China

S. Wu, Y. Hou and G. Yuan

An attempt to estimate the full market and non-market values of Beijing's forests, as well as the sectoral and spatial distribution of the forest benefits.

Y. HOU

Landscape forest around the Great Wall: forests, both natural and planted, have a critical role in Beijing's ecology, aesthetics and socio-economic development

Forest ecosystem goods and services, and the natural capital stocks that produce them, make significant direct and indirect contributions to national economies and human welfare. There have been many attempts to value these contributions. In the past two decades a good deal of progress has been achieved in developing valuation methods for forest ecosystem services and promoting their inclusion in national economic accounts.

In China the valuation of forest ecosystem goods and services has been one of the most researched topics over the past decade, with a rising number of studies at national, provincial and local management unit levels (Yang, Wen and Song, 2008). Many of these have focused on Beijing, carried out with different scales, perspectives and purposes and using different valuation concepts and methods; they have come up with widely varying results.

As the capital of China, Beijing is governed as a municipality under the direct administration of the central government. The municipality is divided into 16 urban and suburban districts and two rural counties extending over approximately 16 800 km^2, of which about 62 percent is mountainous. The municipality has been experiencing rapid economic growth and urban population expansion; at the end of 2007 its resident population was 16.3 million, and per capita gross domestic product (GDP) was 56 000 yuan (around US$7 370).[1]

[1] Conversions in this article use the average annual exchange rate for 2007, US$1 = 7.598 yuan.

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Forests, both natural and planted, and including trees spread across the terrain, have a critical role in the ecology, aesthetics and socio-economic development of the municipality. Beijing's forest resources have been increasing significantly since the 1950s as a result of active planting and management. At the end of 2007, the municipality's forest area reached almost 1.1 million hectares (Figure 1), with a total standing timber volume of 13.7 million cubic metres. The dominant tree species include *Quercus mongolica*, *Platycladus orientalis*, *Pinus tabulaeformis*, *Populus davidiana*, *Betula platyphylla*, *Robinia pseudoacacia* and *Larix principis-rupprechtii*. The forests are rich in biodiversity, hosting a variety of fauna and flora.

This article reports an attempt to estimate the full market and non-market values of these forests, using the latest survey data on Beijing's forest resources. Unlike most other valuation studies, it also includes an analysis of the distribution of the benefits from forest goods and services among economic sectors and among local, regional and global beneficiaries.

There are naturally many limitations to both the current and previous studies, many of which are pointed out in the article, and it is recognized that experts are unlikely to reach consensus on non-market values. Such efforts are nevertheless important to help raise awareness of the multifunctional roles of forest ecosystems, and can ultimately contribute to the conservation and sustainability of forest resources.

STUDY FRAMEWORK

The study applied an updated framework for valuation of forest ecosystems proposed by Hou and Wu (2008) with reference to authoritative international documents in the field (Eurostat, 2002a, 2002b; United Nations *et al.*, 2003; Millennium Ecosystem Assessment, 2003; FAO, 2004) (Figure 2).

The framework distinguishes between assets (natural capital stocks) and production (the flow value of forest goods and services), which have generally been mixed together in other valuation studies in China. Change in the former indicates whether forest management is sustainable or not. The latter is what should be counted in GDP or green GDP.

In this framework, the benefits people obtain from forests are classified into three categories: forest goods, environmental services and sociocultural benefits. Forest environmental services have been included in most studies in China, but the new framework includes an additional and innovative category, forest environmental assets. This concept differentiates, for example, forest carbon storage (as an asset) from forest carbon sequestration flow (as a service).

The valuation method in this study involved quantification of all forest ecosystem services and goods. The main methods used to value these amounts were the market value, direct revealed preference (replacement costs, productivity loss, cost of illness, etc.) and benefit transfer methods.

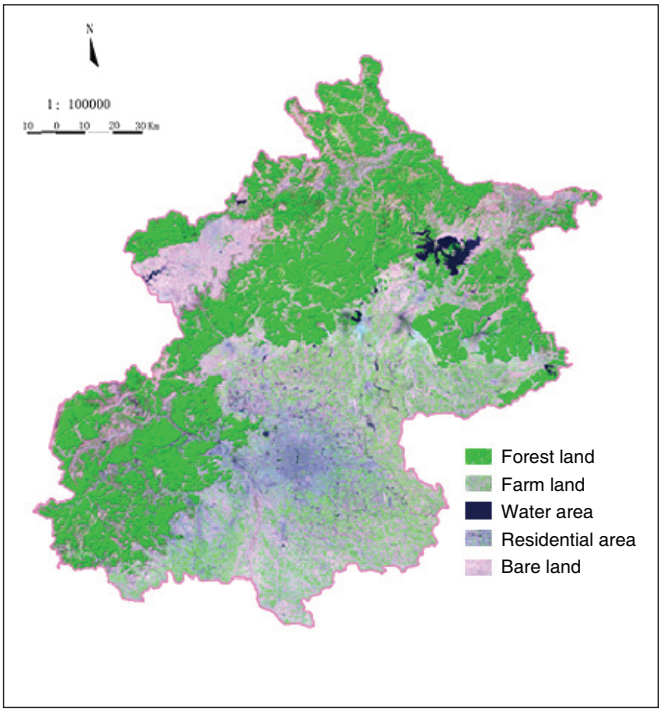
Data on forest area, growing stock, net increment, age classes and species were from a survey conducted by the Beijing Forestry Survey and Design Institute in 2007 applying 3S technology (integrating remote sensing, geographic information systems and global positioning systems) and field investigations. Where value data were taken from earlier studies, they were converted to 2007 values using the consumer price index for Beijing.

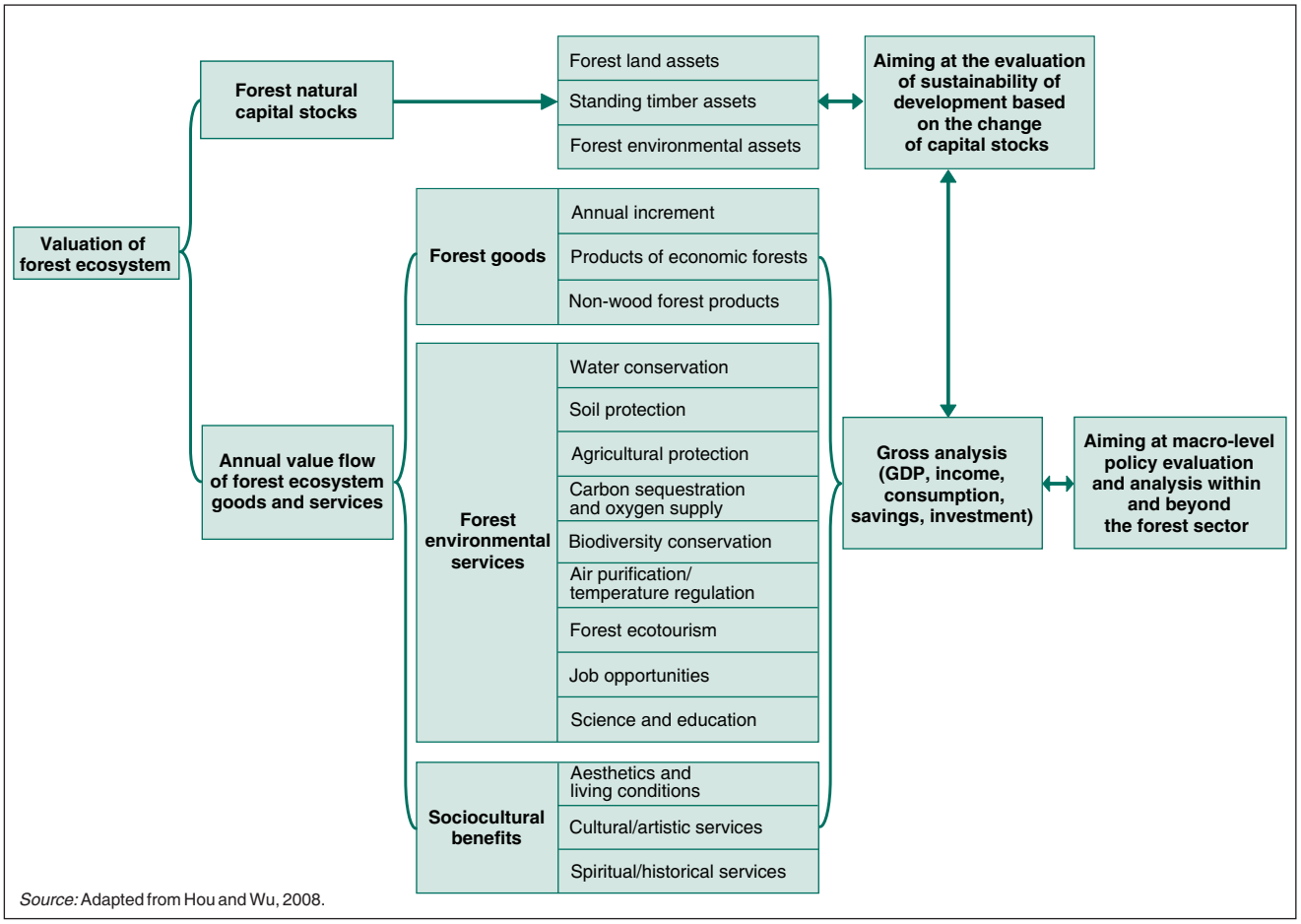
VALUATION CATEGORIES

Forest natural capital

Forest land assets. Forest land, one of the most important economic assets, is generally valued on the basis of market transactions, either directly (e.g. using market prices for bare forest land) or as a ratio of the value of exchanged forest property. In this study, forest land was categorized into five types (forested land, open forest land, shrub land, nursery land and bare forest land) and valued according to the prices of each type. Zhou and Li (2000) applied a stratified sampling method to investigate the transaction

1
Distribution of forest ecosystems and other land use in Beijing





2
Framework for valuation of forest ecosystem services and natural capital

prices for different types of forest land in the Beijing area. Their results were converted to 2007 values.

Standing timber assets. A simple stumpage value method was used for the valuation of standing timber. Stumpage prices by species and diameter were taken from existing transactions in the study area and in southern China. In the latter case, the prices were adjusted using the ratio of consumer price index for the area of origin to that of Beijing (and other conversion factors as needed). These prices were applied to the stock according to its species and diameter composition.

Forest environmental assets. The environmental assets considered in the study were forest carbon stock and forest wildlife.

Estimates of forest carbon stock and stock changes were calculated based on growing stock and net increment using the biomass expansion factors (BEFs) of the Intergovernmental Panel on Climate Change (IPCC, 2004). The value of forest carbon stock assets was calculated by multiplying forest carbon stock by the carbon price derived from the Badaling forest farm carbon project in Beijing (178 yuan or US$23 per tonne CO_2).

For Beijing's rich wildlife resources, the study adopted the value estimated by Zhou and Li (2000) based on a valuation of wildlife for the whole country (State Environmental Protection Administration of China, 1998) and data on China's and Beijing's wildlife resources, with conversion to the 2007 value.

Forest goods

Annual increment of standing timber. The value of the annual increment of the forest stand was estimated by the stumpage value method using the annual increment by species and age classes and the corresponding stumpage prices per cubic metre by species.

Products of economic forests. The market value method was used to estimate the value of fresh fruits, nuts and flower products from economic forests, i.e. forests of economic value including those that have been specifically planted for these products. The production data were taken from the *China Forestry Statistical Yearbook 2007* (State Forestry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"Green reservoir" services of forests include the capture, storage and purification of water

Administration, 2007), and the prices came from market surveys and direct observations.

Non-wood forest products (NWFPs). The value of the main non-wood forest products (wild medicinal materials, mushrooms, wild vegetables, bee products and hunting, as well as tree breeding and planting, which are listed as NWFPs in Chinese forestry statistics) was calculated using the market value method. Production data for these products were from a survey conducted by the Beijing Municipal Bureau of Landscape and Forestry in 2007.

Forest ecosystem services

Water conservation. "Green reservoir" services of forested watersheds include the capture and storage of water (contributing to the quantity of water available during the dry season) and the purification of water through the filtering of contaminants and the stabilization of soils. The total value of water conservation services was estimated based on the water regulating capacity and the cost of supplying water for the city (which includes the sewage treatment fee).

Water quantity was estimated by the water balance method, using the forest area and rainfall data to get the total water input into the catchments and subtracting evapotranspiration and surface runoff for each forest type. The maximum water quantity regulating capacity was seen as equal to the total storage capacity of the catchment forests, and its value was estimated using the replacement cost method (using the cost of establishing a conventional water reservoir in Beijing, taken from Yu and Wang [1999] and Zhang *et al*. [2008] and converted to the 2007 value).

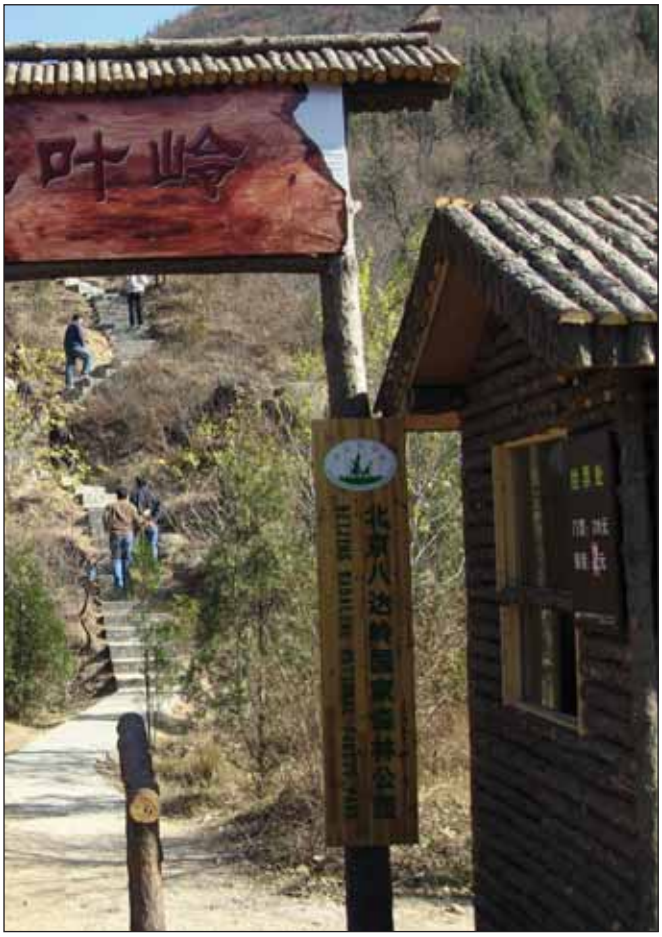
Soil protection. Forest vegetation helps stabilize soils, reduce surface erosion and sedimentation and maintain soil fertility. The estimated value of soil stabilization primarily reflects the costs associated with sediment clearance, calculated with the replacement cost or avoided cost method, using the average cost for sediment dredging in the Beijing area and the finding of Yu and Wang (1999) that the soil erosion on non-forested lands is 3.7 tonnes per hectare per year higher than that on forested lands in Beijing. The value of soil fertility protection was estimated by applying the market value method, assuming that the forested soil around Beijing contains on average around 2 percent compound fertilizer (Yu and Wang, 1999) and using the observed market price of compound fertilizer in 2007.

Agricultural protection. The study focused on the increased crop production benefits provided by forest shelterbelts. The market value method was adopted to estimate this value based on the increase in crop production, the area of cropland with forest shelter and the price of the crop.

Air purification and temperature regulation. Air pollution is the greatest of Beijing's environmental problems, and the municipal government has proposed tree planting as a measure to alleviate it (Yang *et al*, 2005). This study valued the services of forests in the removal of sulphur dioxide (SO_2), nitrogen oxide (NO_x) and fluoride and the suppression of dust, based on the average removal rates for these pollutants by broadleaves and conifers as


S. WU

Xiangshan (Fragrant Hills) Park, a popular scenic spot for Beijing residents and visitors of all ages, has important value for outdoor recreation as well as air quality and temperature regulation – and also raises the value of the surrounding houses



FAO/J. CARLE

Forest ecotourism – a marketable environmental service (collection of entrance fees, Badaling National Forest Park)

reported in the *State report on biodiversity of China* (State Environmental Protection Administration of China, 1998). The costs of removing these pollutants were calculated based on air pollution charges in China.

The study also included the value of noise reduction by the so-called "four sides" tree belt (comprising trees on non-forested lands beside villages, houses, roads and watercourses), estimated based on the length of the tree belt, its capacity to reduce noise, and the market price of using soundproof materials. Based on Leng *et al.* (2004), it was assumed that a 4 to 5 m wide tree belt can reduce noise by 5 decibels if trees are distributed appropriately. The "four sides" belt comprises 51.9 million trees, i.e. 103.9 million metres of a double-line tree belt 8 m wide.

The study's analysis of remote sensing, field investigation and meteorological data showed that in areas of Beijing with forest vegetation, temperature was decreased by an average of 3℃ in summer (May to September). Forests also conserved heat in winter (December to February), although the effect was less pronounced. Other studies (e.g. Li *et al.*, 2002; Jiang, Chen and Li, 2006; Wu, Wang and Zhang, 2009) have indicated similar findings in this regard. The value of temperature regulation by forests was calculated based on the electricity saving achieved through reduced use of air conditioning in summer, applying the direct market method.

Carbon sequestration and oxygen supply. Annual carbon sequestration was estimated using the net primary production of forest stands and the soil carbon sequestration by type of forest stand, derived from the literature (Fang, Liu and Xu, 1996). Again, the carbon price was derived from the forest carbon project in Badaling forest farm of Beijing. The oxygen price was the observed price of industrial oxygen.

Forest ecotourism. The travel cost method has often been used to estimate the value of forest ecotourism. Because of limited time and funding, the present study applied the results from other research: the ecotourism value estimated by Zhou and Li (2000) for the 11 forest parks of Beijing, converted to the 2007 value. This value was multiplied by the total forest area used for ecotourism to estimate the total value of forest ecotourism.

Biodiversity conservation. The study adopted the average per-hectare value of forest biodiversity conservation for the Beijing area estimated by Zhang (2002) using the opportunity cost method, multiplied by the forest area of Beijing.

Forest sociocultural benefits

Job opportunities. Employment creation was considered as a social rather than an economic benefit because the capacity of forests to provide traditional employment in remote communities was seen as more important than the strictly economic benefits of employment creation, since employment opportunities are abundant in Beijing. The analysis covered direct and indirect employment, using data on personnel and wages from the *Beijing Statistics Yearbook 2007* (Beijing Statistics Bureau, 2007).

Science and education. Under sociocultural benefits the study focused on scientific research and education, while ecotourism benefits were valued separately (above). The study adopted as unit price the average value of science and education estimated by Zhang (2004) in

TABLE 1. Different types of output from Beijing's forests

Output	Marketable		Non-marketable		Total	
	Billion yuan	Billion US$	Billion yuan	Billion US$	Billion yuan	Billion US$
Forest goods	6.77	0.89	–	–	6.77	0.89
Forest ecosystem services[a]	1.12	0.15	39.96	5.26	41.08	5.41
Forest environmental services	0.38	0.05	39.66	5.22	40.03	5.27
Forest sociocultural benefits	0.74	0.10	0.30	0.04	1.04	0.14
Total	**7.89**	**1.04**	**39.96**	**5.26**	**47.85**	**6.30**

[a] Includes forest environmental services and sociocultural benefits.
Note: The ratio of services to goods is 6.07. The ratio of non-marketable to marketable goods and services is 5.06.

the Beijing Songshan National Natural Reserve using the expenditure method. The total value was estimated by multiplying this unit price by the total area of forest parks and nature reserves in Beijing.

RESULTS

Stock value of forest natural capital

The value of the capital stock of the forest resources of Beijing reached 19.5 billion yuan (US$2.6 billion) at the end of 2007, of which forest environmental assets accounted for 44.8 percent, standing timber 39.2 percent and forest land 16.0 percent. The per capita stock of forest natural capital was 1 192 yuan (US$157).

Annual flow value of forest goods and services

The flow value of annual output of forest ecosystem goods and services of Beijing was 47.9 billion yuan (US$6.3 billion), of which forest environmental services accounted for 83.7 percent, forest goods 14.2 percent and forest sociocultural benefits 2.2 percent. In other words, the value of intangible forest environmental services and sociocultural benefits was six times that of the forest material goods. The forest goods were all marketable. Of the forest environmental services, only forest ecotourism was marketable. As for the sociocultural benefits, job opportunities were marketable while the scientific and educational benefits were not. Therefore, most of the value of the annual output of forest ecosystem goods and services of Beijing, 39.7 billion yuan (US$5.3 billion), was not realized through the existing market system. Non-marketable outputs had 5.1 times the value of marketable outputs (Table 1).

Among the forest environmental services, water conservation and air purification had the most important role (Figure 3). This finding accords with the real situation in Beijing: Forest inventory data indicate that the city has scant water resources, obtaining 80 percent of its drinking-water from the Miyun Reservoir of Beijing. Protection forests account for 62.1 percent of the forest area, and watershed forests account for 86.6 percent of these protection forests. Beijing is listed among the world's ten most polluted cities (World Bank, 2000), but its forests are making a notable contribution to improving environmental and air quality.

GDP and annual output of forest goods and services

The flow value of the annual output of forest ecosystem goods and services in Beijing amounted to 5.3 percent of its GDP in 2007. Broken down further, the value of forest goods amounted to 0.8 percent of GDP and forest environmental services and sociocultural benefits amounted to 4.6 percent. The value of marketable forest outputs amounted to 0.9 percent of Beijing's GDP, and non-marketable output 4.5 percent.

However, the share of forest goods and services included in Beijing's official GDP in 2007, in accordance with the current national accounting system, was only 0.2 percent.

DISTRIBUTION OF FOREST BENEFITS

Among different economic sectors

The current system of national accounting records the direct economic outputs from forests such as timber and timber-related products, part of the non-wood forest products and forest ecotourism. However, part of these outputs are counted in the forestry sector, and part

3 Forest environmental services in the Beijing municipality

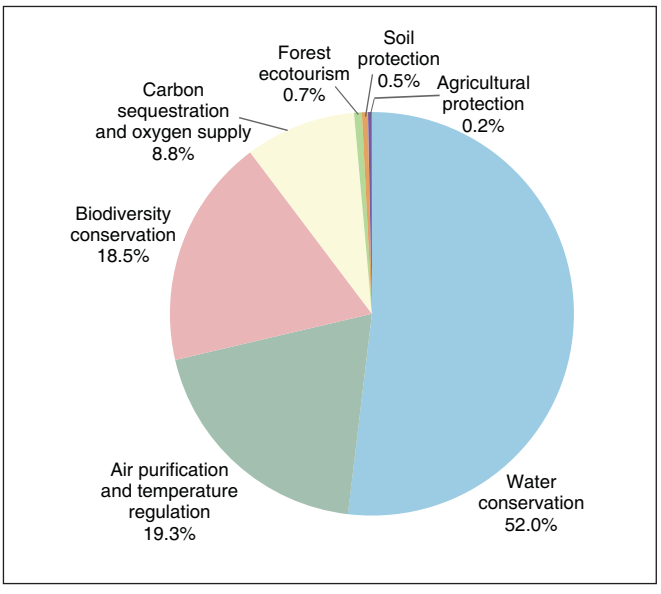


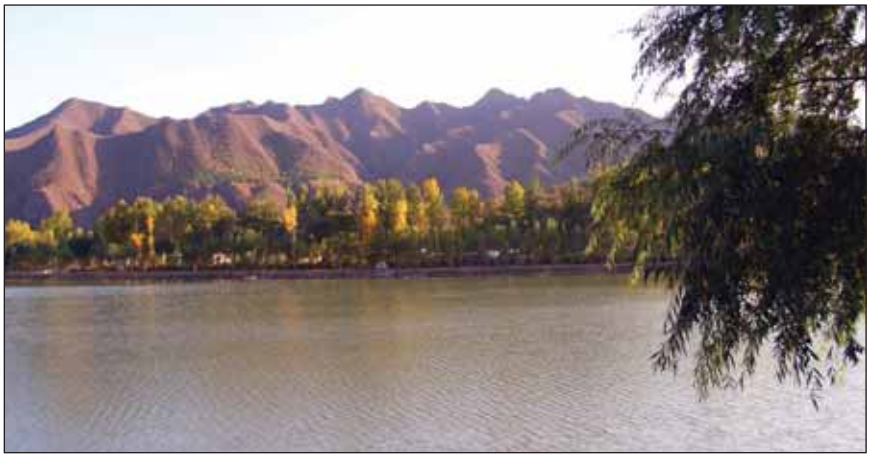
TABLE 2. Distribution of forest benefits among different economic sectors

Output	Forestry		Other sectors											
			Subtotal		Environment		Water		Agriculture		Tourism		Science, education and culture	
	Billion yuan	Billion US$	Billion yuan	Billion US$	Billion yuan	Billion US$	Billion yuan	Billion US$	Billion yuan	Billion US$	Billion yuan	Billion US$	Billion yuan	Billion US$
Forest goods	4.48	0.59	2.29	0.30	–	–	–	–	2.29	0.30	–	–	–	–
Forest environmental services	0.21	0.03	39.82	5.24	25.14	3.31	14.19	1.87	0.11	0.01	0.38	0.05	–	–
Forest sociocultural benefits	0.74	0.10	0.30	0.04	–	–	–	–	–	–	–	–	0.30	0.04
Subtotal	5.44	0.72	42.41	5.58	25.14	3.31	14.19	1.87	2.41	0.32	0.38	0.05	0.30	0.04
Share of total flows (%)	**11.4**		**88.6**		**52.5**		**29.7**		**5.0**		**0.8**		**0.6**	

in the agriculture and tourism sectors. Forest ecosystem services besides forest ecotourism are not included at all in national economic accounts but are partly indirectly reflected in the outputs of related sectors or industries.

The analysis indicated that the value of forest goods and services to non-forestry sectors of the economy accounted for 88.6 percent of the total flows, of which the environment sector accounted for 52.5 percent and the water sector 29.7 percent (Table 2). The importance of the forests of Beijing to these sectors of the economy is thus clear.

Catchment forests around the Miyun Reservoir, which provides 80 percent of Beijing's water



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Among different groups in society

The analysis showed that communities living just outside the Beijing municipality and those residing elsewhere in China were the largest receivers of benefits from Beijing's forests, receiving 47.3 percent of the total flow value of forest ecosystem goods and services (Table 3). Such non-local communities benefit directly from recreation and indirectly from environmental services such as watershed protection, even though they may not be fully aware of the value of the indirect benefits they receive.

Local beneficiaries, living in close proximity to the forest, received 31.2 percent of the benefits. These beneficiaries are usually aware of the direct benefits they receive from the forest.

Global beneficiaries received 21.5 percent of the benefits, through services such as carbon storage, biodiversity conservation and international tourism.

CONCLUSIONS: POLICY IMPLICATIONS

Unless most forest values are recognized through institutionalized valuation methods, forests as a land use will not get the societal attention needed to make them an integral part of a sustainable global economy. Many attempts in this direction have been made in China, as in many other parts of the world, but because of the wide differences in concepts and methods, the many estimates of forest ecosystem goods and services made in the past have been inconsistent and not amenable to meaningful comparison across services and periods.

As natural capital and ecosystem services become more stressed in the future, on account of both greater demand and reduced supplies (in part due to changing climate), their value can be expected to increase. Given the huge uncertainties involved, it may never be possible to have a precise estimate of the value of ecosystem services. Nevertheless, even crude estimates provide a useful starting point (Costanza *et al.*, 1997), with implications for decision- and policy-making. What this study makes clear is

TABLE 3. Distribution of forest benefits among different groups in society

Output	Local beneficiaries		Regional beneficiaries		Global beneficiaries	
	Billion yuan	Billion US$	Billion yuan	Billion US$	Billion yuan	Billion US$
Forest goods	6.77	0.89	–	–	–	–
Forest environmental services	7.4	0.97	22.35	2.94	10.28	1.35
Forest sociocultural benefits	0.74	0.10	0.30	0.04	–	–
Subtotal	14.92	1.96	22.65	2.98	10.28	1.35
Share of total flows (%)	**31.2**		**47.3**		**21.5**	

that forest ecosystem services provide an important part of the total contribution to economic development and social welfare of Beijing. The forest natural capital stock that produces these services must thus be given adequate weight in the decision-making process.

In recent years, the importance of forest ecosystems to Beijing has been well recognized, and the forest sector has been getting an increasing share of the public budget for forest protection and management. The institutionalization of payment for forest ecosystem services has become a prominent policy issue. A special fund has been allocated to local communities for tending of protection forests in the mountainous areas since 2004.

The share of forest goods and services actually included in Beijing's GDP accounting, however, is a small fraction of the flow value of the annual output of forest ecosystem goods and services shown in this study. This finding could support requests for a larger share of the national budget for forest management and investment, which are often woefully underfunded in many developing countries.

The demonstrated importance of forest ecosystem services to other sectors, especially water and environment, could contribute to the design of economic instruments such as water resources fees and environmental taxes which could be used to promote sustainable forest use or to compensate local communities. This finding could also be helpful in building cross-sectoral alliances based on mutual benefits.

The analysis of distribution of forest benefits among different groups in society is useful in identifying obstacles to sustainable forestry. Local communities in mountainous areas of Beijing, for example, have had to forego some forest uses in order to maintain a sustainable flow of forest protection services, and these foregone benefits need to be compensated adequately. The incentive for sustainable forestry declines when local communities do not receive appropriate benefits. The identification of stakeholders provides a good basis for negotiations over payments for forest ecosystem services.

Estimation of the full range of values from forests is helpful in designing forest management strategies. Forests have multifunctional uses to society, and by quantifying the relative values and identifying the economic trade-offs among competing uses of forests, it should be possible to determine optimal and secondary targets for forest management, use and investment, and to take appropriate measures to achieve them.

Forest valuation can also demonstrate the impacts of non-forestry policies on forest use. It can help identify potential conflicts between the development objectives of forestry and those of other sectors, as well as within the forest sector, for the design of a forest strategy that takes into account all stakeholders.

Finally, these findings can be used to raise public awareness of the multiple values of forests to society.

The absence of a real market for most of the forest ecosystem services discussed in this article implies a certain degree of subjectivity in the valuation process, and it is likely that many experts would hesitate to concur with the actual values assigned to these services, even if they agree with the methodology in general. However, the central purpose of this study will have been achieved if it helps to further robust debate on the valuation process. ◆

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Fire in the seasonal semideciduous forest: impact and regeneration at forest edges

A.C.G. Melo and G. Durigan

At the edge of forest fragments, tree recovery after fire is constrained by grasses and vines, which recover more quickly and are also more susceptible to fire.

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Fire is one of the main factors causing biodiversity losses in tropical forests. Its main effects on ecological processes in these forests are losses in stocks of biomass, changes in hydrological cycle and nutrients (Salati and Vosep, 1984) and impoverishment of native plant and animal communities (Pinard, Putz and Licona, 1999), which may be followed by biological invasions (Mueller-Dombois, 2001).

Biodiversity losses are reported to be especially intense at forest edges. The lower humidity and greater number of dead trees (flammable material) make edges of fragmented forests more prone to frequent fires than the forest interior (Cochrane, 2003; Laurance *et al.*, 2001; Uhl and Kauffman, 1990). In addition, a higher density of lianas and exotic grasses from the surrounding pastures is common. Previous studies have found that lianas hamper the regeneration of fragments affected by fire (e.g. Castellani and Stubblebine, 1993; Rodrigues *et al.*, 2004) and that decreases in the density and richness of the seed bank after fire are greater at the edge of the forest (Melo, Durigan and Gorenstein, 2007). It could thus be expected that structural and floristic losses, as well as the resilience of plant communities, depend on the distance from the forest edge.

To test this hypothesis, the study reported in this article examined the effects of fire on plant communities at different distances from the edge of a fragment of seasonal semideciduous forest in Brazil. The article also characterizes the dynamics of the recovery of forest structure and species richness after the fire.

DETAILS OF THE STUDY

The studied area is in the northern part of the Ecological Station of Caetetus in the state of São Paulo, Brazil (22°23'17"S and 49°41'47"W). The climate is tropical with a dry season usually lasting from April to August. The forest is separated from neighbouring coffee plantations by a dirt road 5 m wide, where the invasive grass *Panicum maximum* proliferates.

An accidental fire occurred in October 2003, at the end of an exceptionally long dry season, burning an area about 60 to 80 m wide and 300 m long. This area was compared with a neighbouring unburned forest 40 m distant from the burned forest, having the same environmental conditions as the control.

Five permanent transects (10 m wide and 50 m long) were installed in each sector (burned and unburned), from the edge to the forest interior, each consisting of five plots of 10 x 10 m^2. A distance of at least 10 m was maintained between transects. For comparison, the plots were grouped into two strips according to their distance from the forest edge: 0 to 20 m (external) and 20 to 50 m (internal).

Six months after the fire, all individuals of arboreal species (at least 1.7 m tall) were identified, labelled, measured and categorized as:

- survivors: living trees with no signs of burned canopy;
- dead: plants with no leaves and no signs of regrowth;
- shoots: aerial structures burned, sprouts from the stem base or from roots up to a maximum distance of 50 cm from the stem;
- recruits: plants emerging from seed after the fire.

Structural parameters and floristic richness of tree species in forest regeneration after fire compared with unburned forest at the Ecological Station of Caetetus, Brazil

Time after fire (months)	Basal area (m^2/ha)								Density (trees/ha)							
	Total		Surviving trees		Seed bank trees		Sprouting trees		Total		Surviving trees		Seed bank trees		Sprouting trees	
	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal
6	0.78	3.58	0	2.12	0.58	1.37	0.20	0.09	1 290	3 559	0	193	1 100	3 235	190	131
15	2.57	6.47	0	2.12	2.16	4.00	0.41	0.36	1 690	4 120	0	193	1 310	3 555	380	372
24	3.49	10.01	0	2.12	2.96	7.48	0.53	0.41	1 890	4 327	0	193	1 430	3 787	460	520
Not burned	20.68	20.26							1 870	3 607						

Time after fire (months)	Cover (%)						Number of tree species							
	Trees		Lianas		Grasses		Sprouting		From seed		Surviving		Total species richness	
	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal
6	20.0	50.6	79.9	69.3	11.8	0.6	8	10	6	10	0	16	14	26
15	47.7	85.6	81.2	70.1	13.4	1.8	13	22	11	13	0	11	19	32
24	47.3	87.5	85.2	76.9	14.1	0.1	15	23	13	23	0	11	24	37
Not burned	62.4	70.8	71.4	62.0	9.8	0							45	66

Vegetation cover was also assessed, in percentage of land occupied by the projection of the aerial structures (branches, leaves) in two parallel lines in each plot, 3 m from its lateral limits. Trees, lianas and grasses (*P. maximum* only) were measured separately.

In the burned sector, all data were collected at 6, 15 and 24 months after the fire. In the unburned sector, data were collected 24 months after the fire.

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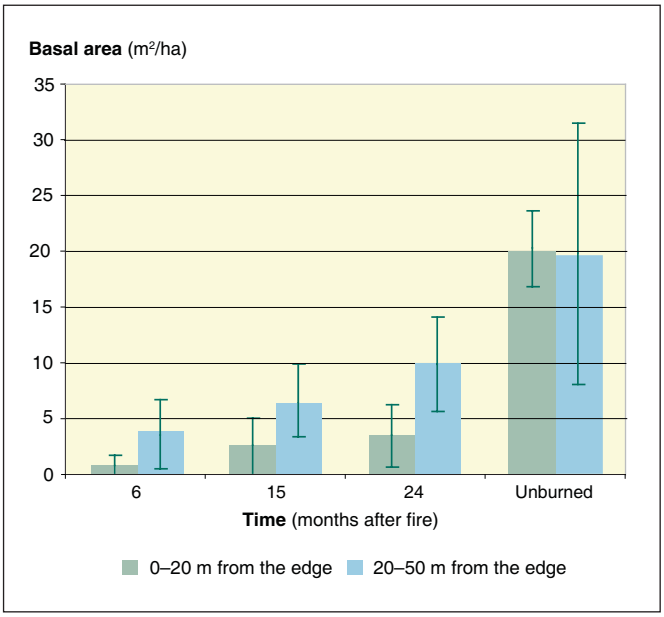
Arboreal basal area in different periods post-fire in comparison to unburned forest, Ecological Station of Caetetus, Brazil (vertical lines indicate standard deviation)



INTENSITY OF DAMAGE

The fire caused damage of major consequence to the structure and floristic composition of the forest. Both internal and external strips of burned forest differed considerably from the unburned forest in tree density and biomass (represented by basal area) (Table). The shorter the distance from the edge, the higher the intensity of damage (Figure 1).

The estimated loss of biomass by fire ranged from 89 percent of the basal area in the internal strip to 100 percent in the external strip. The loss of biomass indicates the intensity of fire and therefore the degradation which the event may have caused the plant community (Kruger, 1984a; Whelan, 1995). In the external strip, where trees were fewer, the fire was probably more intense because of the greater availability of easily combustible grasses and lianas, as well as the lower relative humidity normally found in edges of forest fragments (Forman, 1995).

RECOVERY OF STRUCTURE AFTER FIRE

The rate of forest recovery also varied with distance from the edge. Both the

A.C.G. MELO

Forest edge, two days after fire

A.C.G. MELO

Forest edge six months after fire; burned trees and high biomass of the grass **Panicum maximum** *are visible*

A.C.G. MELO

Forest edge 18 months after fire, with abundance of grasses and lianas climbing dead and living trees

vulnerability to fire and the recovery varied among species.

Overall, 24 months after the fire, the biomass measurement of the burned forest had not reached that of the unburned forest, and the recovery of biomass was slower in the external strip (Figure 1). At this time, trees from the seed bank or seed rain already accounted for the largest portion of the basal area (Table) as compared with surviving trees and sprouts of pre-existing individuals.

If the increase in basal area of the burned forest remained constant at the rate estimated for the first two years by regressions, the internal strip would require 5 years and the external strip 11 years to achieve their original biomass.

The tree canopy cover stabilized nearly 15 months after the fire in both strips but was higher in the internal strip.

The differences in tree biomass (density, cover and basal area) between the strips at 24 months after the fire can be explained by several factors:

- the density of trees was also lower closer to the edge before fire, decreasing the availability of sprouts for regeneration;
- the seed bank was considerably reduced in the external strip (Melo, Durigan and Gorenstein, 2007);
- the already scarce seedlings and sprouts of arboreal species in the external strip faced strong competition from vines and invasive grasses.

Grasses and lianas (from the seed bank or sprouting from suckers) quickly recovered in the burned area in the first six months after fire. Vines quickly covered the area during this time but did not increase considerably thereafter. Vines have a more diverse spectrum of adaptation to vegetative replication than trees (Gerwing, 2003) and have great capacity for regrowth, which ensures rapid occupation of disturbed sites, so they are obviously more abundant at the edges (Janzen, 1980; Putz, 1984).

Increased frequency of lianas (woody and herbaceous) with increased intensity of fire has also been reported (Cochrane and Schulze, 1999).

The grass growth rates were very high. Coverage by *P. maximum* was always higher in the external than in the internal burned plots. It was also generally higher in the external burned strip than in unburned forest. Once established, grasses can reduce the light availability on the forest floor up to 99 percent (Hughes and Vitousek, 1993), impairing the germination and recruitment of tree species. In addition to hampering the development of tree species, grasses provide dry fuel in the winter, leaving the area prone to new fires.

IMPACT AND RECOVERY OF FLORISTIC RICHNESS

The response of plants to fire, even within the same population, depends on the intensity of fire in each location and the morphological characteristics and location of each individual (Whelan, 1995). Ivanauskas, Monteiro and Rodrigues (2003), studying the effects of fire in seasonal forests in Mato Grosso, Brazil, found mortality rates ranging from 0 to 100 percent among 76 species.

In the present study, the burned forest had, in general, much lower tree species richness than the unburned forest (Table). Of the 77 tree species sampled in the unburned forest, 43 (56 percent) were not sampled in the burned forest at 24 months after the fire.

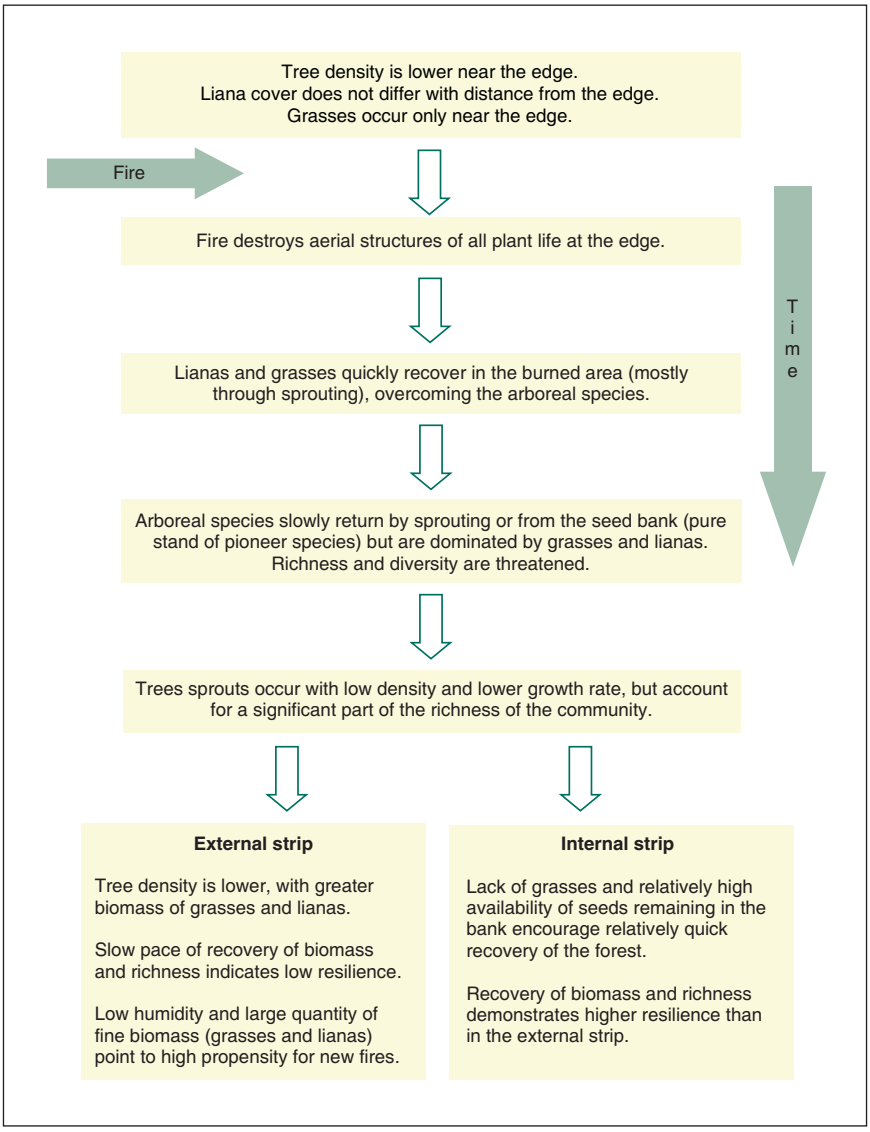
The elimination of species in the burned forest can be temporary if the fire reaches only part of the forest, as they can be reintroduced by seed dispersal or wind. However, the results suggest that fire can lead to local extinction of some species if the whole fragment is burned.

In general, both ranges from the edge showed an increase in the number of tree species throughout the period of monitoring (Table). Species returned over time, for a gradual recovery of the richness of the community. Even so, 24 months after the fire the burned forest still had fewer species than the unburned forest in both strips.

From the sixth to the twenty-fourth month after fire, a significant increase in the density of sprouts was observed in both strips. The importance of sprouting as a strategy for survival in post-fire regeneration has been reported for various tropical forest ecosystems (Uhl *et al.*, 1981; Kruger, 1984b; Rouwn, 1993; Marod *et al.*, 2002; Kennard *et al.*, 2002).

Previous studies have shown that seasonal semideciduous forest has a considerable number of species capable of regrowth after fire (Castellani and Stubblebine, 1993; Hayashi *et al.*, 2001; Rodrigues *et al.*, 2004). However, the lack of long-term monitoring of burned communities makes it impossible to draw conclusions about fire as an element of evolutionary pressure in this type of forest.

2
Model proposed for two years of post-fire regeneration at the edge of seasonal semideciduous forest



CONCLUSIONS

Fire was a strong agent of degradation in the studied forest, almost completely destroying the arboreal biomass, as well as remarkably reducing species richness in the arboreal layer. Recovery of forest biomass was very slow (low resilience) in both strips.

Recovery of the forest structure was faster the larger the distance from the edge; this pattern appears to be related to the edge effects already existing before the fire.

The grasses, present almost exclusively near the forest edge, do not prevent the arrival of seeds but do inhibit germination, establishment and development of seedlings. Certainly their rapid proliferation in the post-fire community inhibits the development of arboreal species from the seed bank and affects the regenerating community. So, in the strip 0 to 20 m from the edge of the fragment, the density of trees is much lower than in the more internal strip, where grasses are virtually absent.

The results make it possible to infer a model for structural changes in fragments of semideciduous seasonal forest over a two-year period after fire (Figure 2). It is proposed that the rate of recovery of tree biomass is constrained mainly by the presence of grasses and vines which rapidly occupy the burned area and are highly flammable. The convergent conclusions from this and other studies (Cochrane and Schulze, 1999; Pinard, Putz and Licona, 1999; Cochrane, 2001, 2003; Mueller-Dombois, 2001; Slik *et al.*, 2008; Veldman *et al.*, 2009) suggest that the proposed model is applicable to other fragmented tropical forests wherever fire has been a persistent threat, exacerbated by edge effects in a vicious circle.

Management strategies for preventing fire damage in forest fragments should be directed towards controlling the proliferation of grasses and vines along the forest edges rather than just installing firebreaks. Shelterbelts of fire-resistant and non-invasive species can be used to reduce light incidence at the forest edges to discourage growth of grasses, as an alternative to chemical control with herbicides. ◆

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Challenges of mobilizing forest finance in a heavily indebted poor country: case study of Uganda

J. Kamugisha-Ruhombe

An examination of planning, budgeting and fiscal resource allocation in Uganda demonstrates a disconnect between the global discussion on forest finance and national realities in heavily indebted poor countries.

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International forest-related discussions emphasize that implementation of sustainable forest management depends on mobilizing adequate financial resources. In adopting the Non-Legally Binding Instrument on All Types of Forests, the United Nations Forum on Forests (UNFF) agreed to reverse the decline in official development assistance (ODA) for sustainable forest management, to mobilize significantly increased, new and additional financial resources from all sources and to take action to raise the priority of sustainable forest management in national development plans and poverty reduction strategies.

The Paris Declaration on Aid Effectiveness, endorsed at the Paris High-Level Forum in 2005, commits donors and recipients to harmonize, align and manage results-based aid and to improve the quality of aid and its impact on development (OECD, 2008). The governments and development institutions adhering to the declaration commit themselves to, among others:

- strengthen partner countries' development strategies and associated operational frameworks;
- increase alignment of aid with partner countries' priorities, systems and procedures and help to strengthen their capacities;
- enhance donors' and partner countries' accountability to their citizens and parliaments;
- define measures and standards of performance and accountability of partner country systems.

With changes in civic governance, domestic public budget is increasingly allocated through sector-wide-approaches (SWAPs), basket funding and medium-term expenditure frameworks (MTEFs), and in alignment with national poverty reduction strategies.

One of the major instruments influencing financial allocation in Uganda is the Heavily Indebted Poor Countries (HIPC) Initiative, launched in 1996 by the International Monetary Fund (IMF) and the World Bank to ensure deep, broad and fast debt relief to contribute towards growth, poverty reduction and debt sustainability in the poorest, most indebted countries. To qualify for debt relief, HIPCs must maintain macroeconomic stability, carry out key structural reforms and satisfactorily implement a poverty reduction strategy. Uganda has satisfied these provisions and consequently received "irrevocable" debt relief amounting to about US$2 billion (World Bank, 2009). However, the required fiscal reforms also limit the funding available to sectors that are not considered high priority.

The Paris Declaration opens up new opportunities for countries to secure increased ODA for sustainable forest management, but only if forestry is included as a priority in national development. This has not happened in Uganda. Under the Poverty Action Fund, which uses the money saved under the HIPC Initiative, environment and natural resources (excluding lands) management is allocated only 0.06 to 0.11 percent of the budget for 2006/07 to 2009/10 (Table 1) – and this entire allocation goes to wetlands management; nothing goes to forestry.

This article examines planning, bud-

TABLE 1. Poverty Action Fund (PAF) resources combined with medium-term expenditure framework (MTEF) (billion U Sh)

Sector	2006/07 (approved)			2007/08 (projected)			2008/09 (projected)			2009/10 (projected)		
	PAF	MTEF	Total	PAF	MTEF	Total	PAF	MTEF	Total	PAF	MTEF	Total
Agriculture	67.48	146.58	214.06	79.49	184.86	264.35	85.18	350	434.71	107.48	542	649.67
Environment and natural resources (excluding lands)	**0.72**	**22.54**	**23.26**	**0.72**	**29.73**	**30.45**	**1.29**	**32**	**33.03**	**1.57**	**35**	**36.17**
Security	0.00	377.27	377.27	0.00	396.90	396.90	0.00	397	396.90	0.00	397	396.90
Works and transport	40.99	464.88	505.87	40.99	563.70	604.69	40.99	646	686.67	56.99	744	800.65
Education	585.86	720.81	1306.67	600.83	752.34	1 353.17	621.55	1 975	2 596.27	673.90	3 270	3 944.07
Health	206.01	381.85	587.86	206.36	386.45	592.81	223.81	817	1 040.43	242.51	1 283	1 525.45
Water	62.35	99.23	161.58	83.14	128.32	211.46	80.98	292	373.42	121.98	495	617.38
Justice, law and order	20.88	195.75	216.63	20.88	201.78	222.66	21.68	244	266.02	23.48	290	312.98
Accountability	38.56	197.11	235.67	38.61	216.58	255.19	40.78	296	336.75	41.87	379	420.49
Economic functions and social services	18.46	670.84	689.3	31.88	720.25	752.13	36.32	788	824.77	57.38	882	939.53
Public-sector management	77.28	258.26	335.54	77.28	288.25	365.53	77.28	443	520.09	77.28	597	674.65
Public administration		318.42	318.42		307.66	307.66		308	307.66		308	307.66
Interest payment due		253.90	253.9		300.02	300.02		300	300.02		300	300.02
Total	**1 118.59**	**4 107.44**	**5 226**	**1 180.18**	**4 476.84**	**5 657.02**	**1 229.86**	**6 887**	**8 116.74**	**1 404.44**	**9 521**	**10 925.62**
% share of environment and natural resources	0.06		0.45	0.06		0.54	0.10		0.41	0.11		0.33

Source: MoFPED, 2007.
1 US$ = 1730 U Sh (December 2007).

geting and fiscal resource allocation in Uganda, demonstrating a disconnect between the global discussion on forest finance and national realities in heavily indebted poor countries.

FOREST GOVERNANCE IN UGANDA

In 2005, 17 percent of the total land and swamp area of Uganda was forested and 41 percent of the forested area was in protected areas, conservation areas under the management of the Uganda Wildlife Authority or forest reserves under the management of the National Forestry Authority (NFA) and district forestry services (NFA, 2007). The rest is on private land and managed with the technical support of district forestry services. Many areas also feature various forms of farm forestry, and the district forestry services provide advisory services on their management. Constitutional provisions commit the State to sustainable forest management, and the government approved a National Forestry Plan in 2000, a new Forestry Policy in 2001 and a National Forestry and Tree Planting Act in 2003. These instruments commit government to implement sustainable forest management and set aside the permanent forest estate for sustained provision of forest goods and services.

DEVELOPMENT PLANNING

The National Planning Authority prepares the National Development Plan, drawing on Uganda's poverty reduction strategy (the Poverty Eradication Action Plan), the anchor of the country's development. The National Development Plan is implemented through a rolling three-year MTEF, which is reviewed and extended during the annual budgeting cycle. The budgeting process, based on a National Budget Framework Paper, involves consultation with all stakeholders and approval by Parliament.

At the subnational level, District Councils prepare comprehensive and integrated development plans. The District Councils develop the annual workplan and budget through a conference of all stakeholders. The Local Governments Act of 1997 obliges District Councils to formulate, approve and execute their plans and budgets in accordance with national priorities.

FISCAL ARRANGEMENTS AND FLOWS

The Government of Uganda funds local governments via three kinds of grants.

- ***Unconditional grants*** are paid annually from the Consolidated Fund for decentralized services and are calculated on the basis of the human population in the district. They are part of District Council revenue and are integrated in its budget.
- ***Conditional grants*** are provided to finance specific programmes. They are separate from district government revenue, budgeted for separately and appended to the main budget.
- ***Equalization grants*** are paid from the Consolidated Fund to districts that lag behind the average national standard for a particular service.

SECTOR-WIDE APPROACH IN ENVIRONMENT AND NATURAL RESOURCES

The SWAP shifts focus from institutional to sector-wide interests within a given sector, promoting shared management and implementation systems and emphasizing common vision, priorities, objectives and goals. Areas for support are no longer defined based on institutional priorities and plans. Stakeholders engage in a participatory process to define sectoral priorities and plan institutional contributions to realize them. This approach is intended to provide greater efficiency and equity in the distribution of resources, more flexibility in the use of funds and more effective partnerships among stakeholders. The SWAP in environment and natural resources includes all stakeholders in forestry, fisheries, wetlands, climate, wildlife and environment and is implemented through a sectoral working group led by the Ministry of Water and Environment.

FORESTRY IN NATIONAL PLANNING

The theme of the National Development Plan is "Growth, Employment and Prosperity for Socio-Economic Transformation". The development scenario focuses spending on the sectors with the greatest potential to contribute to economic growth. It curtails spending in non-priority sectors and supports development in priority sectors through increased aid. Forestry is among the primary growth sectors (those that directly produce goods and services), but forest-related objectives are also included in complementary sectors such as energy, land, water and environment. The National Development Plan provides for, among others:

- increasing State investment in reforestation, afforestation and forest restoration;
- increasing private investment in forestry and promotion of agroforestry;
- instituting a policy, legal and institutional framework for governing privately owned forests.

The MTEF for 2009/10 to 2013/14 (MoFPED, 2009) has the following forestry priorities:

- strengthening institutional and community capacity and regulatory and fiscal framework for forest and watershed management;
- providing operational resources and in-service training for national and subnational teams;
- supporting district and other subnational natural resource planning processes;
- developing participatory plantation plans and promoting tree planting in private lands, local forest reserves and degraded areas;
- mobilizing farmers into tree planting groups;
- forming and training field teams and carrying out boundary surveying and demarcation of forest reserves;
- controlling illegal activities in central forest reserves and systematically removing encroachers;
- training and sensitizing timber traders and sawmillers;
- developing and implementing forest management plans;
- monitoring production, processing and movement of timber products;
- adjusting the size of the NFA payroll;
- identifying seed sources/stands and producing seedlings for sale to the public.

The Sector Investment Plan for environment and natural resources covers ten

S. NSITA

More than 40 percent of Uganda's forest area is in government-managed protected areas, conservation areas or forest reserves

S. NSITA

Much of Uganda's forest area is on private land, and family and farm forestry are common

years (2008/09 to 2017/18) (Ministry of Water and Environment, 2007). Within this plan, strategic objectives for forestry include:

- improving the ability of forests and trees to yield increased benefits (economic, social and environmental) for all people;
- conserving and managing wildlife and protected areas;
- establishing laws, policies, regulations, standards and guidelines;
- strengthening the capacity of lead agencies and other institutions to implement programmes on environmental management;
- restoring degraded forest ecosystems;
- promoting research.

The budget for forestry constitutes 46 percent of the Sector Investment Plan budget. This makes forestry a very high priority. However, the key determinants regarding the financing actually allocated to a given sector are budget ceilings which are set by the Ministry of Finance, Planning and Economic Development on the basis of resource envelopes available for fiscal control to ensure macroeconomic stability to qualify for debt relief. Thus, while the forestry subsector has the lion's share of the budget allocation in the Sector Investment Plan and could actually mobilize the recommended funding from willing donors, MTEF ceilings hinder it from accessing the funding (Figure 1).

So despite strong positive statements, the environment and natural resources sector in general and forestry in particular are not given a corresponding priority in national and subnational budget allocation (Table 1). It is clear that the priorities in the MTEF could never be achieved with the budgeted funding, even if all the money were released (which is often not the case).

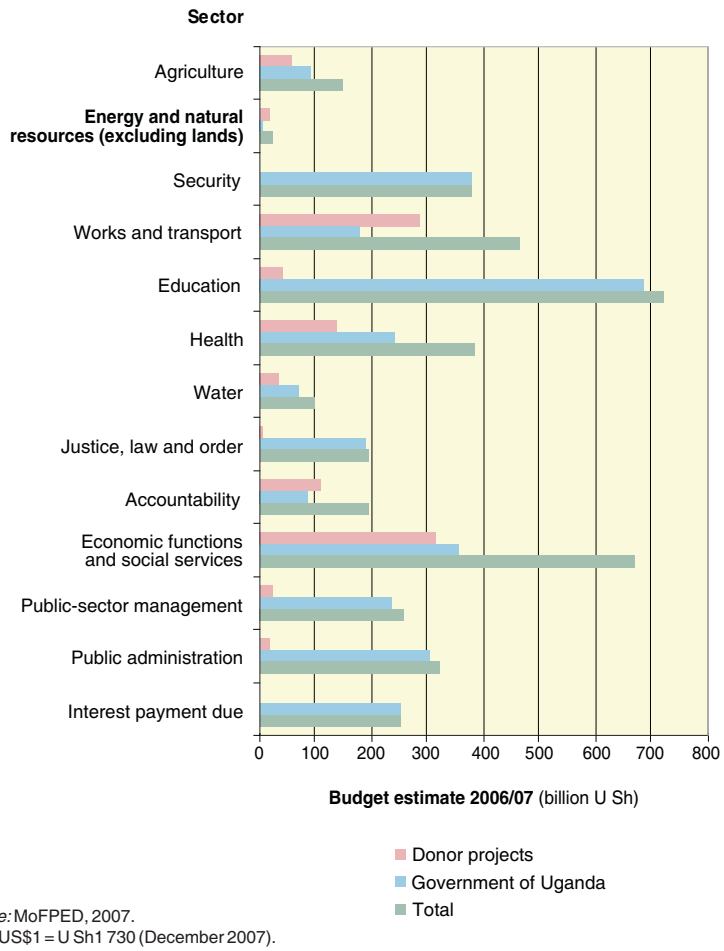
REVENUE RETENTION

NFA is a self-accounting statutory body with its own planning and budgeting

Restoration of degraded forest ecosystems is one of the objectives of the Sector Investment Plan for environment and natural resources

S. NSITA

1
Environment and natural resources in Uganda's medium-term expenditure framework (MTEF)



Source: MoFPED, 2007.
Note: US$1 = U Sh1 730 (December 2007).

TABLE 2. National Forestry Authority (NFA) income statements (million U Sh)

Source of revenue	2004/05	2005/06	2006/07
Own revenue	5 420.08	6 438.91	8 262.84
Government subsidy	163.94	194.16	23.97
ODA	6 679.43	7 281.31	6 012.61
Subtotal	12 263.45	13 914.37	14 299.41
Own revenue as % of total	44	46	58

Source: NFA Annual Report, 2006/07.
Note: US$1 = U Sh1 730 (December 2007).

TABLE 3. Impact of timber monitoring systems on revenue

Year	Total revenue		Impounded timber revenue		Impounded timber revenue as % of total
	Million U Sh	US$[a]	Million U Sh	US$	
1995/96	148.2	142 475	36.8	35 378	24.8
1996/97	602.8	566 290	33.6	31 565	5.6
1997/98	760.4	656 015	111.2	95 935	14.6
1998/99	812.9	594 732	78.9	57 725	9.7
1999/2000	1 044.7	680 498	134.1	87 350	12.8
2000/01	1 518.0	842 197	57.2	31 735	3.8
2001/02	1 159.5	675 898	18.9	11 017	1.6
2002/03	1 408.6	768 405	3.7	2 018	0.3
2003/04	2 563.0	1 294 514	184.7	93 288	7.2
2004/05	3 075.0	1 810 560	247.9	145 964	8.1
2005/06	4 223.0	2 300 858	317.8	173 150	7.5

Source: National Forestry Authority databases, 2007.
[a] US$ values are based on mid-year exchange rates.

process. At establishment, the bulk of its budget was funded through ODA as up-front investment for the first four years. Although the agency's own revenue has increased over the years, a substantial proportion of its funding still comes from ODA (Table 2). The progressive increase in NFA's revenue (Table 3) can be attributed to its businesslike approach, robust law enforcement, good governance and initial strong support from government. For example:

- the Law Enforcement Section monitors the movement of forest products and publicly auctions all illegal forest produce impounded, for transparency and to generate the best prices the market can offer;
- competitive bidding limits corruption and creates realistic market prices – raising the average price of 1 m^3 of pine roundwood from 28 100 shillings (U Sh) (US$15.7) in 2004/05 to U Sh70 000 (US$38.3) in 2005/06;
- revenue collection has been decentralized and expenditure tied to it as an incentive for staff to develop mechanisms for generating revenue.

It is clear that law enforcement and governance can generate substantial forest finance.

BUDGETING THROUGH SPECIFIC PROJECTS

Experience of using ODA for budget support increasingly shows that it is difficult to guarantee concrete results, although the attributes of a holistic approach to development are theoretically attractive, particularly in sectors like environment and natural resources that are not politically vote-winning. However, although the Government of Uganda encourages budget support funding, some donors are still funding projects. Projects funded by ODA are required to remain within the MTEF ceilings and must address priorities in the National Budget Framework Paper. In contrast, forestry projects implemented by civil society organizations have no standard planning and budgeting procedure and are immune to MTEF ceilings.

PRIVATE-SECTOR FOREST FINANCE

Private-sector funds have an important role in financing forestry nationally and locally, but these sources are largely undocumented, and therefore their importance often goes unnoticed. Investment from private sources is increasing (Figure 2), even as public-sector funding decreases (Figure 3). A stimulus to private investment is the Sawlog Production Grant Scheme, a €2 million (US$2.7 million) up-front grant from the European Union (EU) that refunds 50 percent of tree farmers' costs, provided certain technical standards are followed. In 2009 an additional €10 million (about US$14 million) was approved by the EU, as well as another 36 million Norwegian kroner (about US$6 million) to take this scheme to 2013. The funds are part of ODA although the activities funded are carried out by private tree farmers. These grants are outside MTEF ceilings. Another factor in the growth of private investment is the Ugandan Government's decision to rent forest reserve land to tree farmers on flexible terms.

A recent survey (Global Mechanism, unpublished, 2009) estimated that from 2002 to 2008, private sources contributed over US$41 million to development of forest plantations in Uganda. Small- to medium-scale tree growers (with up to 500 ha) accounted for 99.8 percent of the investors in commercial forest plantations and 69 percent of the planted area (15 104 ha), which indicates that tree growing is becoming an attractive small- to medium-scale enterprise even if the payback is long term. Almost half of the investors (48 percent) used personal savings, followed by 27 percent using funds from trading or business, 12 percent using personal loans from financial

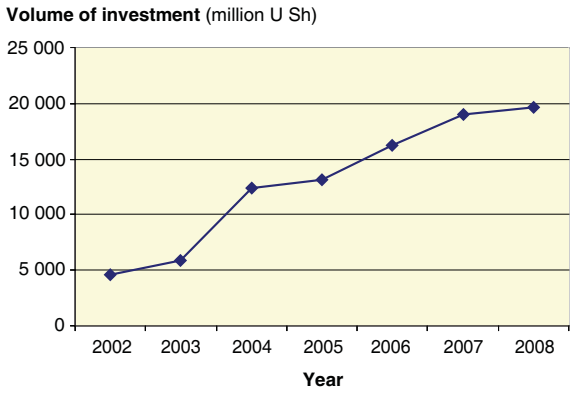
institutions and 8 percent using grants from donors. Not one respondent had received a loan earmarked for forestry by a financial institution.

Of the private-sector investment in commercial forestry operations, 71 percent went to tree growing and management. Natural forest management accounted for 4 percent. Ecotourism and production of medicinal plants accounted for 1 percent each. Forest-based enterprises such as beekeeping, ecotourism and medicinal plants, often touted for their importance in forest management, do not seem to have interested many private owners of natural forests as yet.

The survey results suggest that people are investing in forest management for profit, motivated by the low risk they associate with tree growing, the promise of future income and the availability of land in central forest reserves under licence. Financial gain and security are the driving forces behind their investment in forest management rather than environmental protection *per se*; however, responsible management of forests for financial gain should also help conserve the environment. The innovative sources of funding that have become popular at the international level (carbon, payment for environmental services, corporate social responsibility) are virtually unknown at the forest management level. Since 2003/04, the gap between donor funding for environment (which includes forestry) and domestic investment in commercial timber plantations has been closing (Figure 4).

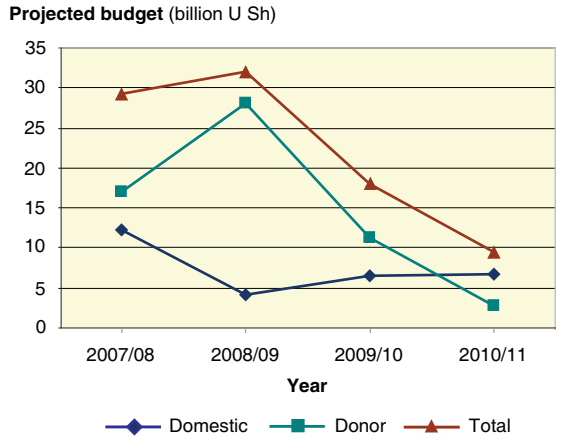
As observed above, public financing for environment is expected to continue declining from 2009/10 to 2011/12 (Figure 3). The MTEF estimates a drop of nearly 62 percent in public-sector funding (donor and domestic) over those three years. On the other hand, investment in forest management from domestic private-sector sources has grown by nearly 330 percent. Given the interest in commercial tree growing generated since 2002, it is likely that funding from

2 Private-sector funding from domestic sources, Uganda (2002–2008)



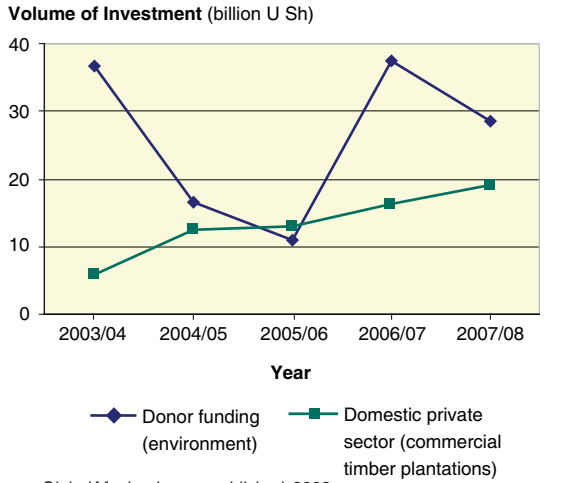
Source: Global Mechanism, unpublished, 2009.
Note: US$1 = U Sh1 988 (December 2008).

3 Public funding (domestic and donor) for environment (including forestry) for the period 2007/08–2010/11, Uganda



Source: Global Mechanism, unpublished, 2009.
Note: US$1 = U Sh1 927 (December 2009).

4 Trends in financing forest management in Uganda



Source: Global Mechanism, unpublished, 2009.
Note: US$1 = U Sh1 927 (December 2009).

domestic private-sector sources will continue to increase.

CONCLUSIONS

Uganda has a new forest policy and new forestry legislation, has restructured forestry governance and has developed a National Forestry Plan, which has been mainstreamed into the poverty reduction strategy. Uganda has decentralized governance, elaborate planning and budgeting procedures and impressive fiscal transfers. To the extent possible, the country has implemented all the key outcomes of the global forest dialogue and the tenets of the Paris Declaration. Despite this effort, forestry is still not a priority in terms of budget allocation; there is a mismatch between the poverty reduction strategy, Sector Investment Plan and MTEF targets and the eventual financial allocations, which severely hampers implementation. Reasons for the scantness of forestry funding may include the following.

- Forestry has a major role in supporting the development of other sectors of the economy (agriculture, construction, health, water, energy, industry and environment) but this link is difficult to demonstrate, mainly because it takes a long time for the impact of forests (or their absence) to show.
- Forestry in Uganda is dominated by an informal sector which lacks institutional visibility, record-keeping and regulatory and organizational structure, leading to huge losses in forest revenues for government.
- Political commitment in favour of forestry is inconsistent at both the national and subnational levels. Many political actors recognize the socio-economic and environmental value of forests but have little courage to support investment in the sector.
- With the advent of electoral democracy, the average politician's immediate interest is to be elected. Politicians will allocate resources to projects that will easily garner votes (roads, schools, hospitals).

Above all, however, budget ceilings are the main cause of low financial allocations to forestry. Herein rests an apparent contradiction in international support: While the Paris Declaration embraces respect for country priorities, the budget ceilings established by Uganda are in practice a conditionality under the HIPC Initiative, since heavily indebted poor countries must have a poverty reduction strategy and MTEF with ceilings to qualify for debt relief.

The current global debate on forest finance revolves around whether "increased new and additional financial resources from all sources" should be provided through a global forest fund or a facilitative mechanism. The question is, if either of these were established tomorrow with billions of dollars, how would a highly indebted poor country like Uganda access the resources for forestry in view of the budget ceilings? There are 40 such countries, a number of them in the "highly forested low deforestation" category. The question of budget ceilings is therefore a pertinent one. The debate also appears to assume that the new and additional resources must be provided by developed countries to developing countries. This attitude not only contradicts other agreed recommendations, but also ignores the key clause "from all sources". Forest law enforcement and governance can yield substantial resources as shown in Table 3, and a simple stimulus can evoke an enormous private-sector response as shown in Figure 2.

There is still work to be done at the national level to unleash the full

S. NSITA

Financial gain and security are the driving forces behind private investment in forest management, but responsible management of forests for financial gain should also help conserve the environment

S. NSITA

While public-sector investment in forestry is declining, private-sector investment in commercial tree growing is increasing, especially on a small to medium scale

potential for domestic forest finance, and global dialogue needs to focus on this. Poor policies and laws, indirect subsidies, poor law enforcement, weak institutions, excessive and/or inadequate regulation, corruption, low absorption capacities, unstable macroeconomic regimes, budget ceilings and local politics are but a few of the issues that need urgent attention. If these were dealt with, domestically generated public and private-sector funds, supported by ODA, would fulfil an important leveraging function to boost the quality and quantity of forest finance at the national level, hence paving the way towards sustainable forest management. ◆

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How can Turkey's forest cooperatives contribute to reducing rural poverty?

E. Atmiş, H.B. Günşen and S. Özden

Constraints on the efficiency of Turkey's forest cooperatives suggest that small is not always beautiful.

Forest cooperatives are generally created to assist forest owners in obtaining the best value for goods and services. They help forest owners participate in activities such as afforestation, tending and protection; produce and distribute superior planting stocks; provide members with up-to-date technical information and training; and collect, grade, process, pack and distribute forest products. They contribute to local skills and business development, mentoring and employment, and can also promote democracy and good governance (ICA, 2003).

In Turkey, where almost 100 percent of forest is State owned, forest cooperatives have been established primarily to improve the income and living conditions of people living in forest villages, and thus to reduce the socio-economic pressures on the forest (Daşdemir, 2002). Forest villages are those containing a forest within their administrative borders. They typically have a living standard far below the national average, limited education and healthcare services and high unemployment rates. Today Turkey has more than 21 000 forest villages; their combined population is 7 million (10 percent of Turkey's population), although it has been declining with rural-to-urban migration (ORKÖY, 2009). Forest villagers depend on traditional animal husbandry, low-productivity agriculture and forestry work. Their average gross annual income is only US$400 (OGM, 2004), compared with US$5 780 in 2004 for the entire country (State Planning Organization, 2008).

There are 2 123 forest cooperatives in Turkey, with 290 000 members. Most of them focus on the production and marketing of wood. Forest cooperatives distribute among their members such jobs as timber harvesting, debarking, removal and transport, under the supervision of the local forest authority. A small proportion also engage in other businesses such as ecotourism, local handicrafts, petrol sales, dairy and honey production, cultivation of fruits and vegetables, and collection of non-wood forest products.

As incentives, the General Directorate of Forestry (OGM) gives priority to cooperatives in wood production, forest nursery production, afforestation, forest maintenance and building of forest roads. Government orders for wood are not subject to tender, and are placed with the nearest forest cooperative according to Turkish forest law. To enable cooperatives' right to market sale, OGM sells them one-third of the fuelwood produced in Turkey at cost (i.e. well below the usual market price), as well as some of the wood produced, at discounted prices. The total government subsidy provided

Turkey's forest cooperatives are mostly tasked with organizing work in village forests and distributing the wood harvested from them

H.B. GÜNŞEN

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H.B. GÜNSEN

A villager's shed in the forest: forest villagers typically have a living standard far below the national average

to cooperatives in this way is estimated to be US$80 million a year (OGM, 2004).

In addition, the General Directorate for Forest Village Relations (ORKÖY), within the Ministry of Environment and Forestry, provides funding and low-interest loans to forest cooperatives. It supports marketing of their products, vocational training, preparation of development plans and rural development projects (ORKÖY, 2009).

The forest cooperatives have formed 27 regional cooperative unions, which are in turn under the umbrella of the Central Union of Turkish Forestry Cooperatives (OR-KOOP), established in 1997. OR-KOOP includes 1 349 cooperatives, accounting for 70 percent of the wood production in Turkey. It offers information services and legal and managerial guidance to members, and provides leadership that the forest cooperative system previously lacked (OR-KOOP, 2009).

However, the forestry cooperatives in Turkey have contributed less than expected to reducing rural poverty, decreasing illegal activities in forests, balancing income distribution, training villagers or raising economic, social and cultural levels. A literature review and a survey of forest cooperative leaders and employees, as well as ORKÖY staff, examined the reasons. The survey was carried out in Sinop, Kastamonu, Karabük, Bartın and Zonguldak provinces in the Black Sea Region, Turkey's most forest-rich region (Atmiş *et al.*, 2009).

The following were the main constraints identified.

Legal and institutional problems and ambiguities. Forest cooperatives are administered under three different laws and two ministries (Environment and Forestry, Agriculture), with conflict sometimes resulting. Although the national forest programme states that priority will be given to increasing the capacities of forest cooperatives (OGM, 2004), about three-quarters of the cooperative presidents felt that the government neither sets policies in favour of the cooperatives nor provides them with sufficient support.

Small scale of activity. Most cooperatives were started in a single village with few members, and thus have trouble operating efficiently, raising financing and obtaining loans. Of those surveyed, 42 percent had 7 to 50 members and 40 percent had 51 to 100 members. Many members are elderly and not actively working.

Single focus on wood production. Because wood production jobs are seasonal, more than half of the cooperatives are active only three months or less per year (and 25 percent only one month). Only about 10 percent of the cooperatives have diversified activities and work year round; these are the ones that have succeeded in reducing the poverty of their members (Demirtaş, 2008). Ortalıca Forest Cooperative in Kastamonu Province, for example, obtains 74 percent of its total income from activities other than wood production, particularly dairy production (Çağlar, 2009).

Marketing. About half of the forest cooperatives surveyed reported marketing problems. The biggest problem with marketing (reported by 83 percent of the cooperatives) was insufficient capitalization. Since most forest cooperative members are poor, all income is shared among the members; no funds are left in reserve to serve as operating capital.

Low level of education and training. In Kastamonu Province, which has the most forest cooperatives, the survey indicated that 68 percent of the cooperative presidents only completed primary school; 8 percent were university graduates. Only 1 percent were trained in cooperative business and management. Indeed, 97.5 percent of the respondents employed by the State Forest Organization commented that managers and members of cooperatives needed training in cooperative business, production, forestry work and marketing of products. Only 7 percent of the cooperatives reported cases in which employers or lenders had provided training before assigning a job or giving a loan.

Weak leadership. Lacking education and managerial skills, most cooperative presidents are unable to provide the leadership required to win the trust and loyalty of their members. Furthermore, the cooperatives are hindered by frequent change of management; more than half of the presidents surveyed were in office for only one to three years.

Few women involved. Turkish laws do not hinder women from starting, joining or leading cooperatives, but social standards are such that the cooperatives have few female members, and none has a woman president.

Greater involvement of women might enhance the cooperatives' effectiveness, encourage the creation of rural women's organizations and help promote equal participation of women in economic, social and political activities.

Conflicts. Communication problems and lack of concrete short-term benefits cause frequent conflicts between the members and management of cooperatives, between cooperatives and their umbrella organizations, and between cooperatives and the forest authorities. In the latter case, the main cause is disagreement over the unit prices for wood fixed by the authorities. Competition for the jobs assigned by the forest authorities also creates conflict among the many small cooperatives.

Recommendations

Strategies that could help improve forest cooperatives' effectiveness in raising the economic and social well-being of forest villages include the following.

- New laws and administrative procedures must be developed to increase the forest cooperatives' power to contribute to reducing rural poverty.
- The possibility for forest cooperatives to receive external grants or initial assistance should be strengthened.
- Market analysis of wood and non-wood forest products is needed.
- Larger cooperatives, started jointly by several villages, could help overcome problems of scale and also reduce conflicts among cooperatives.
- Cooperatives should widen the range of their products to include non-wood products and also forestry services such as afforestation, natural regeneration and forest maintenance.
- OR-KOOP should widen its marketing capacity for new products and provide the marketing facilities that the cooperatives cannot afford to establish by themselves. Quality of existing products should be evaluated, and new markets should be created in towns closer to the producers to avoid problems in transportation of products.
- Managers and members of cooperatives need to be trained in cooperative business, forestry processes, product development, management and marketing. Capacity in leadership, entrepreneurship and organizational aspects should be strengthened.
- The umbrella organization OR-KOOP could help fill the leadership vacuum at cooperative level.
- Gender awareness raising and training for women could help cooperatives benefit from women's creative power and leadership skills.
- To lessen conflicts, a transparent, pluralistic and democratic management approach is needed in the cooperatives.

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Promoting good forest governance for sustainable livelihood improvement: a Tanzanian example

A. Ramadhani

A project in four forest-adjacent villages helped community members identify obstacles to sustainable forest management, propose solutions and begin to implement them.

In the United Republic of Tanzania, sustainable management, use and conservation of forests and woodlands (covering over 35 million hectares or almost 40 percent of the country's land area) are essential for lasting poverty reduction and sustainable development. Thus good forest governance – referring for the purposes of this article to the formulation, administration and implementation of policies, legislation, regulations, guidelines and norms relating to ownership, access, rights, responsibilities and practices for sustainable management of forests at the local or national levels – is of vital importance. Key principles guiding good governance of forests include equity and justice, empowerment, accountability, transparency, subsidiarity and sustainability (Kenya Forest Service and Ministry of Environment and Natural Resources, 2007).

In 2007, the Tanzania-based non-governmental organization Envirocare (see Box) implemented a six-month project to promote good governance in forest management for sustainable livelihood improvement in Kilindi District. The project was supported by the National Forest Programme Facility.

The project worked with four village communities adjacent to Songe-Bokwa forest. It was grounded in the principle that local people's ownership rights and empowerment to govern the resources on which they depend must be recognized. The objectives were:

- to build capacity in forest governance;
- to identify and promote policy, legal, institutional and economic arrangements that contribute to improved forest governance;
- to promote and consolidate equal gender participation in forest decision-making;

About Envirocare

The Environmental, Human Rights Care and Gender Organization (Envirocare) is a Tanzanian non-profit, non-partisan, non-governmental registered organization founded in 1993 and funded by Hivos (the Netherlands), FAO, ReCoMaP (the Regional Coastal Management Programme of the Indian Ocean Countries) and Care Tanzania. Its vision is to see a society with a clean and safe environment that can benefit all citizens equally and in a sustainable way.

Envirocare implements development projects aimed at improving environmental conservation, people's livelihoods and equitable sharing of natural resources, with a human rights and gender based perspective. It has worked in promoting organic farming and improved farming methods; tree planting and participatory forest management at household and community levels; civic education and HIV/AIDS awareness of youth; economic empowerment of vulnerable groups; and women's rights and agricultural policies favourable to the environment.

For more information, see: www.envirocaretz.com

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F. SILAYO

Songe-Bokwa forest was continuously subjected to heavy pressures from livelihood activities, including agricultural encroachment

- to promote and strengthen transparency in allocation and use of forest resources.

Although the scale and budget of the project were relatively small, this experience demonstrates the complex series of actions required to begin to influence forest outcomes in a local district.

SONGE-BOKWA FOREST

The Songe-Bokwa forest in Kilindi District covers about 3 000 ha and shares borders with four villages together having about 10 000 inhabitants: Songe, Bokwa, Vilindwa and Kwamba. The forest is village land; all community members have control over it.

The forest is rich in biodiversity. Economic activities carried out by the forest-adjacent communities include beekeeping, hunting, collection of wild fruits, vegetables, weaving materials and medicinal plants, and extraction of timber and precious stones. Forest resources are thus vital to livelihoods, poverty alleviation and environmental sustainability in the district.

As it was non-reserved, Songe-Bokwa forest did not have a management plan to ensure that local forest-dependent people took responsibility for managing the forest. Sustainability was not given priority; good practices and good forest governance were not in place. The forest was continuously subjected to heavy pressures from livelihood activities such as random felling, setting of forest fires to enable hunting of wild animals and growth of good forage for livestock, agriculture (permanent and shifting cultivation), unmanaged fuelwood gathering, charcoal making, collection of other forest products and herding of cattle, sheep and goats. After seeing that the resulting depletion of forest resources was contributing to drying of water sources, disappearance of traditional medicines and the need for women to walk long distances for fuelwood, village leaders became interested in promoting more sustainable use of the resources.

PROJECT ACTIVITIES

Envirocare organized a series of workshops to identify the problems facing the forest and propose solutions in a participatory manner. Forest-adjacent communities in each of the four villages helped identify the policy, legal, institutional and economic obstacles to sustainable management of the Songe-Bokwa forest and the equitable access and benefits that sustainable forest management entails. Next, communities proposed solutions, and on this basis devised conservation action plans. Other key project activities included training and awareness raising on good forest governance.

Obstacles identified by the communities

Policy and legal obstacles. The national forest policy's failure to regulate trade in wood- and non-wood forest products was a factor facilitating their unmanaged exploitation, permitting forest destruction and degradation. A further obstacle to sustainable forest management was the lack of harmonization in the policies and laws of the various sectors related to land use – agriculture, wildlife, environment, land development, water, energy and minerals – and the lack of an effective mechanism for intersectoral collaboration.

Institutional obstacles. In the usual procedure, the yearly plans for conserving and managing the resources of the Songe-Bokwa forest were generally first discussed by village council members, then taken to the village assembly for public discussion and agreement, and then taken to the ward development council – comprising the village chairpersons and village executive officers of the four villages, the ward executive officer and technical personnel in that particular ward – for further comments. Finally, the plans would be approved by the general meeting of the district (the full council) for implementation.

Unfortunately, village assemblies were not well attended. Local officials with

Forest-adjacent communities met in workshops to identify obstacles to sustainable forest management, propose solutions and devise a conservation action plan

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personal interests in the forest resources could easily take advantage of the ignorance of the community to protect their own interests.

Local government had limited capacity for law enforcement. Forest guards, forest officers and other stakeholders needed training on the provisions of the Forest Act and associated legislation and guidelines.

Economic obstacles. Poverty had increasingly become a major cause of forest decline, since poor forest-adjacent people saw no option but to overexploit the natural resources in order to survive. The communities noted that illegal or unmanaged logging and hunting, collection of medicinal plants, charcoal making and extraction of precious stones were contributing to the degradation of the forest and reducing the quantities of resources available. Investors from outside Kilindi District were also contributing to depletion of the forest resources.

Proposed solutions

Solutions proposed by the community workshops included the following:

- making of by-laws;
- tree nursery establishment;
- alternative income-generating activities;
- establishing boundaries for Songe-Bokwa forest;
- conserving water catchments;
- learning forest policies and laws taking good governance into consideration;
- land-use planning;
- establishing forest patrol groups;
- involving the community in forest conservation and planning for sustainable use of forest resources.

Conservation action plan

Following the discussion on the causes of environmental degradation and proposed solutions for sustainable management of Songe-Bokwa forest, the beneficiaries devised a short-term conservation action plan listing all activities that were to be implemented for the period of August 2007 to November 2008 (Table 1).

TABLE 1. Short-term conservation action plan for Mount Bokwa forest

Activity	Time frame	Responsible
Make by-laws	8/07–10/07	Village chairpersons, village executive secretary, Envirocare
Form forest patrol groups	10/07–12/07	Chairpersons, village executive officers
Start and strengthen beekeeping groups	10/07–11/07	Beekeeping groups, Envirocare, district beekeeping officer
Plant trees	9/07–3/08	Tree nursery establishing groups, Envirocare, district forestry officer
Provide training on hunting wild rabbits using nets instead of fire	10/07–11/07	Elders and Envirocare
Start small income-generation projects (e.g. raising chickens, vegetable gardens, tree nurseries)	10/07–11/07	Group chairpersons, district council, Envirocare
Create awareness on land-use planning	10/07–12/07	Village governments, Envirocare, district land-use officer
Make long-term management plan	8/08–11/08	District council, Envirocare, village governments

Training and awareness raising

In addition to holding local discussions with the communities about good forest governance, the project organized five workshops to train community leaders to promote good practices and raise village awareness. Training was provided for 20 village government leaders and 20 representatives of forest user groups in each village. The training emphasized good governance concepts, local people's empowerment, policy options for promoting good governance in Songe-Bokwa forest, participatory forest resources assessment and transparent procedures for granting concessions for harvesting forest products. Trainees were equipped with the necessary materials, knowledge and skills to train others in their respective communities.

Information materials produced by Envirocare in the local language, Kiswahili, were given to workshop participants for distribution in the villages. These materials included posters on environmental degradation in Mount Bokwa forest and on good governance in forest conservation, as well as the booklet *Understanding forest policy, laws and land rights in Tanzania*.

Workshop participants were trained in good governance concepts including local people's empowerment and participatory forest resources assessment

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Workshop participants received information materials to raise awareness in their villages

The project also addressed the different roles of women and men in livelihood activities with respect to management of the available resources and development of alternative income-generating opportunities. This gender perspective helped promote equitable benefit-sharing and more effective local government.

In addition, village groups were trained on fire prevention methods by the district natural resource officer.

Monitoring progress

To track the efficiency and effectiveness of the planned activities over the course of the project, 20 community members (five from each village) and the Envirocare project management team came together to develop a monitoring system. Measurable indicators were developed in a participatory manner with the beneficiaries (Table 2).

RESULTS

The project results were monitored for two years. The following is a summary of the progress made during that time.

Increased community awareness of policy intentions to promote people's participation

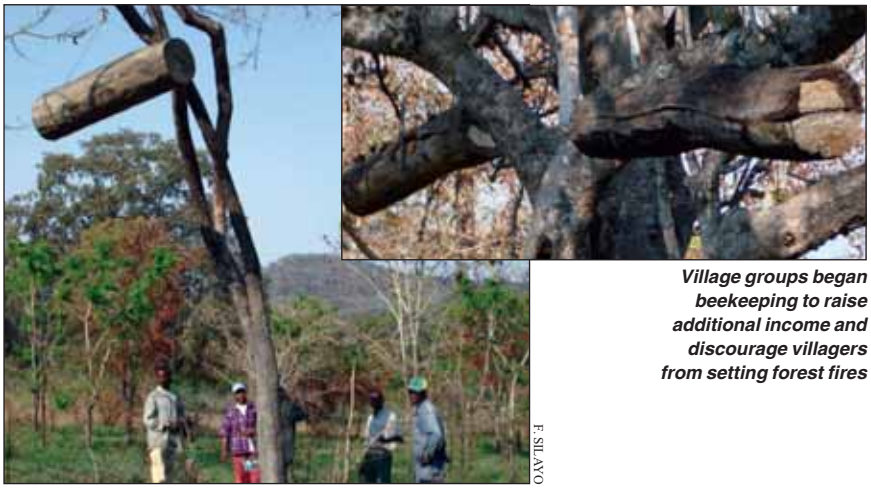
The community was made aware of policy aims to encourage people's participation in forest activities. For example, the National Forest Policy includes the statement that: "Local communities will be encouraged to participate in forestry activities. Clearly defined forest land and tree tenure rights will be instituted for local communities, including both men and women."

Greater community response in village assemblies

Before implementation of the project, the attendance at village assemblies was poor. Of 2 000 people in Songe village, for example, only 100 attended the meetings. But following awareness-

TABLE 2. Development of indicators for monitoring progress

Problem	Source of the problem	Impacts	Solution	Indicators
Forest wildfire	Illegal hunting Honey harvesting Pasture regrowth	Forest degradation	Start income-generation activities Make by-laws Establish boundaries for fire control	Increase in the number of households with small ruminants and chickens Increase in water availability Increase in number of beehives Decrease in cases of forest fire Increase in number of planted trees
Deforestation	Fuelwood collection Charcoal burning Illegal timber logging	Unreliable rainfall patterns Destruction of water catchment	Make by-laws Establish forest patrols Plant trees	Presence of by-laws Increase in number of trees planted Increase in conserved water catchment area
Encroachment of Mount Bokwa	Shifting cultivation Land scarcity Livestock grazing	Soil erosion Destruction of catchment areas	Use best agricultural practices Create awareness on land-use plan	Increase in forest area/cover Increase in water flow
Illegal hunting	Need for income Need for food	Extinction of endangered animal species	Make by-laws Forest patrols Start alternative income-generation activities	Presence of by-laws Increase in number of wild animals Increase in number of small-scale livestock keepers
Charcoal burning	Lack of income Lack of alternative source of energy	Environmental degradation	Look for alternative sources of energy and income Promote tree planting	Increase in number of households using energy-saving stoves Increase in number of trees planted in farms and other areas



F. SILAYO

Village groups began beekeeping to raise additional income and discourage villagers from setting forest fires

raising activities on the importance of participation in forest resource decision-making, attendance increased to 400. More members of the community became concerned about the fast rate of disappearance of their forest resources and recognized the need to participate in decision-making on how the resources should be managed and used.

Enhanced income opportunities

The project resulted in the formation of several community groups focused on alternative income-generating activities, which are helping to reduce pressure on the forest.

In Songe, the Tumaini women's group started keeping local chickens (200) and cultivated a 2 ha farm which produced 20 bags of beans. The group also made 1 000 energy-saving stoves which were sold at an affordable price in their communities, reducing the time needed for fuelwood collection and giving women more time for other household tasks and for rest. In Kwamba, the Mshikamano group established a 0.4 ha vegetable garden which produced 10 bags of tomatoes and 15 bags of sweet peppers. The income-raising activities have empowered women economically.

The Kiegeya group and the Tumaini men's group of Songe and the Ujamaa group of Bokwa started apiaries in their respective villages. The hives were placed in the forest to discourage villagers from setting forest fires, since many villagers were investors in the hives. All together, the groups established 100 hives. On average each hive produces 10 litres of honey per harvest, which is then sold for 5 000 shillings (TSh) (about US$4) per litre.

Increased community response to forest fire, and decreased incidence of fires

Communities in all four villages became active in the prevention of forest fire. They established fire boundaries and engaged forest patrols and income-generating groups in reporting and fighting forest fire. On one occasion a pastoralist set fire to the forest at Kwamba village. The event was quickly communicated to the community and the fire was put out before major damage could occur. The culprit was caught and fined TSh30 000 (about US$25).

In Bokwa village no forest fire incident was reported. In Songe village, which used to experience at least five forest fires per year, there was only one reported fire incident, which was quickly put out by village volunteers. Vilindwa village also reported a significant decrease in forest fire incidence. In Kwamba village, annual incidents decreased to three from a previous minimum of seven. It is likely that greater awareness of the importance of conserving forest resources, increased fire management training and the villagers' desire to protect their beekeeping activities in Songe-Bokwa forest all contributed to the decrease in forest fires.

Decreased encroachment of Mount Bokwa forest

Implementation of the project resulted in the recovery of over 20 ha of forest that had been encroached by cultivators. The recovery could be partly attributed to the influence of the district commissioner, who gave the order for villagers to stop farming in forest areas. But local people's involvement in creating by-laws to discourage encroachment by outsiders, and in convincing their fellow villagers to stop farming on the forested slopes of Mount Bokwa, also had a role.

Tree nursery establishment and tree planting

The project supplied the environmental committee of each village with 1 kg of teak (*Tectona grandis),* arbhorrea (*Gmelina arborea*) and *Grevillea robusta* seeds and watering cans, racks and shovels, with which they established tree nurseries, raising about 10 000 seedlings in total. The seedlings were distributed to the village communities to start their own forest farms.

Creation of local by-laws

To persuade forest-adjacent communities to abide by the forest management rules and regulations, the four villages made by-laws in Kiswahili related to the management, access and equitable sharing of natural resources. These were to be taken to the ward development council for discussion and then to the district council for approval.

Formation of forest patrols

Forest patrols were formed according to the Forest Act No. 14 of 2002. Four patrols of five people each were formed for the four villages. They agreed to

patrol their respective village forest areas (ranging from 71 to 1 666 ha) twice a week on days agreed by them but not disclosed to others. According to the new by-laws, the patrol members are not paid and are therefore exempt from having to work in other village development activities such as construction of classrooms.

CONCLUSIONS AND RECOMMENDATIONS

Although the concept of good governance was relatively new among the beneficiaries, the experience of the project in Bokwa forest was positive. Target groups and stakeholders received the project wholeheartedly; they were eager to learn and cooperated to the fullest during the entire period of project implementation. Forest monitoring continues within other ongoing Envirocare projects in Kilindi District, helping to sustain these outcomes.

The following recommendations may help to continue promoting good governance of forest resource management in the project area and elsewhere.

- ***Put good governance in forest management into practice in all village governments.*** The village governments must make a commitment to the principles of good governance.
- ***Simplify laws.*** To be accessible to villagers, laws need to be drafted in language that they can easily understand – in this case non-technical Swahili.
- ***Make local government more transparent and accountable.*** Accountability in each office is only possible if the people at large, as well as the staff and officers themselves, know what the office is expected to achieve and on which parameters their performance will be judged. All offices involved in natural resource management at the village and district levels should adopt a mission statement and publicize it widely.
- ***Protect and reward whistle-blowers.*** Villages need to devise by-laws that will protect those who expose illegal loggers or people who set forest fires. The village government might institute annual awards to recognize their contributions in exposing wrongdoings detrimental to forest resources.
- ***Maintain discipline in managing natural resources.*** Many villagers consider forests on non-reserved land as no man's land. This perception allows illegal loggers to take out timber and other resources as and when they please; it will have to change if good governance in forest management is to be a reality.
- ***Continue fighting corruption in harvesting and trade of forest products.*** Each village government should identify the areas under its authority that are prone to corruption and take measures to tighten procedures, review the delegation of powers, identify areas of discretion and prepare associated guidelines. Wide publicity should be given to forest-related corruption and the remedial steps taken to deal with it. The public must be convinced that the village government is honest, means business and is bent on eradication of forestry-related corruption.
- ***Mainstream good governance in village meetings.*** In each meeting, the village government could review the steps taken for good governance.
- ***Set up a standing committee on good governance.*** The concept of good governance will have to be refined from time to time to adapt to changing societal requirements. A standing committee in each village could continuously interact with stakeholders to make suitable recommendations on the subject.
- ***Strengthen and motivate the forest patrols.*** The forest patrols need to be equipped with the necessary gear for effective operation (e.g. overalls, boots, torches) and should continue to be exempt from participating in other village development activities.
- ***Strengthen income-generation groups.*** Groups generating income through forest conservation related activities, for example tree nursery establishment, tree planting and production of energy-saving stoves, need to be supported in obtaining access to markets for their products.
- ***Allocate unprotected forest land for conservation and sustainable use by villagers.*** The Kilindi District authority should legally give the communities adjacent to Songe-Bokwa forest the role of conserving it and using its resources sustainably. ◆

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Work in the forestry sector: some issues for a changing workforce

C. Ackerknecht

On labour unions, occupational health and safety, training and changes in the workforce – with particular reference to Chile.

Forests cover one-third of the world's land area, and 84 percent of them are publicly owned. In 2006 global gross value added from forest products was US$467 908 million, accounting for 1 percent of gross domestic product (GDP). Forestry (considered here as wood production, wood processing and pulp and paper industries) provided employment to 13.7 million people in 2006, accounting for 0.4 percent of the world's jobs (Table 1) (FAO, 2009).

The International Labour Organization (ILO, 2005a) defines work as "human activities, paid or unpaid, that produce the goods or services in an economy, or supply the needs of a community, or provide a person's accustomed means of livelihood". In the past decade, ILO has shown a special concern for decent work, which is defined as that performed "in conditions of freedom, equity, security and human dignity" (ILO, 1999). Decent work is characterized as being:

- productive and secure;
- respectful of labour rights;
- providing adequate income;
- having social protection;
- maintaining a social dialogue with freedom of union association, collective negotiation and participation of all the parties involved.

This article addresses some common issues of relevance to the world's forest workers. It does not, however, address the negative impacts of the international financial crisis on work in the forest sector. [*Ed note:* That subject has been addressed in depth in *Unasylva* 233.]

At the global level, information on forestry employment is scarce or inconsistent. This article relies heavily on examples and data from Chile, which has statistics and specific studies related to the forestry sector available covering the past 40 years, as well as an occupational health and safety system recognized as one of the best in the world.

FOREST EMPLOYMENT

The Global Forest Resources Assessment 2005 (FAO, 2006) collected information on forestry employment just in primary production (excluding process-

TABLE 1. Employment in the formal forestry sector (wood production, wood processing, pulp and paper) in 2006, by region

Region	Forest employment 2006 *('000 workers)*	% of total employment	Growth trend
Africa	530	0.1	Unstructured
Asia and Pacific	5 811	0.3	Increasing slightly
Europe	3 815	1.1	Decreasing
Latin America and the Caribbean	1 510	0.7	Increasing
North America	1 677	0.8	Decreasing
Western and Central Asia	365	0.2	Increasing moderately
World total	**13 709**	**0.4**	

Source: FAO, 2009.

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FAO/FO-6982/A. WHITEMAN

Much of the work in the world's forests is informal, characterized by poor working conditions, low pay, and lack of job security and health and safety protection

ing of wood and non-wood forest products). Although 138 countries reported on this parameter, differences in the data collected made it difficult to draw conclusions. Some countries, for example, reported part-time work without converting to full-time equivalents; some included sawmilling while others included only roundwood production; and some included fuelwood collection, while others did not.

Even before the financial crisis, the number of forest workers was declining; it had fallen by about 1 million since 1990 (FAO, 2009). The decline was substantial particularly in Asia and Europe as a result of mechanization, business restructuring and the privatization of State activities. Other countries saw slight increases. Blombäck and Poschen (2003) estimated that the forest workforce would decrease by 7 percent between 2003 and 2013 in Europe and the Commonwealth of Independent States because of reductions in tree felling quotas imposed by legislation or environmental regulations. In the United States of America it was estimated that sources of employment in agriculture, forestry, hunting and fisheries would decrease by 0.8 percent annually between 2006 and 2016 (United States Bureau of Labor Statistics, 2007).

Although there are no firm estimates, much of the work in the world's forests and wood industries is informal; in other words, it does not provide social security protection for workers. This is particularly true in developing countries, where only 23 percent of workers in all sectors are enrolled in some form of social security or welfare system for themselves and their families, as compared with 86 percent in developed countries (Superintendencia de Seguridad Social, Chile, 2007). Informal work is often characterized by deplorable working conditions, low pay, and lack of job security and health and safety protection.

However, international regulations that companies must observe in order to gain or retain access to external markets, such as clean production mechanisms, corporate social responsibility obligations and commitments involved in obtaining forest certification, are being put in place to improve the situation.

UNIONIZATION AND ORGANIZATION OF WORKERS

Forest workers' union activities date back at least a century in Europe and spread to other parts of the world with immigration. In the North American forest sector, the union movement began with the founding of the International Woodworkers of America (IWA) in the United States in 1937; a branch opened in Canada in 1946. IWA had its highest membership – about 115 000 workers – in the 1970s, but by 1994 the United States branch had only about 20 000 active members, so it merged into the International Association of Machinists as the Woodworkers Department (IAM, 2009).

In Latin America, the labour union movement has not been as pervasive as in North America. Chile, for example, has about 136 unions, but it is estimated that no more than 10 percent of the forest sector workforce has union membership (Ackerknecht, 2003).

The body currently covering the greatest number of forest-sector workers is the Building and Wood Workers' International (BWI), created in December 2005 from the International Federation of Building and Wood Workers and the World Federation of Construction and Wood Workers. The current organization comprises 318 unions representing approximately 12 million members in

Training is key to improving safety and productivity in forest operations

ACIS

the building, building materials, wood, forestry and related sectors in 130 countries (BWI, 2009).

TRAINING AND SKILLS CERTIFICATION

In many countries, the main problem facing forest enterprises seeking to improve the productivity and safety of their operations is the lack of good training for the workforce. Most countries have adequate training systems for engineering and other high-level technical skills, but few programmes to develop the skills needed by timber- and woodworkers to perform safely and productively while protecting the environment.

The compulsory training programmes established in some developed countries are worthy of note. In Germany, for example, operators of power saws and other forestry equipment are required by law to follow a three-year course under the guidance of a forestry supervisor. An additional 800-hour advanced course is required for those desiring to become supervisors.

In an attempt to standardize training for workers in Europe, the Leonardo da Vinci Learn for Work Project in Austria, Belgium, the Czech Republic, Finland, France, Germany and the Netherlands produced a methodology to monitor and evaluate the level of skills among forestry workers.

In 2006, 47 percent of forest enterprises in Australia reported that 80 to 100 percent of their workers were trained (FAFPESC, 2006). In New Zealand, it was estimated in 2008 that about 80 percent of the forest-sector workforce had the necessary qualifications (I. Boyd and J. Siegfried, personal communication, 2009).

Despite these efforts, many countries, especially developing countries, still have large numbers of workers requiring proper training.

OCCUPATIONAL SAFETY AND HEALTH

In many countries, the failure to report health and safety incidents in the workplace hampers provision of the effective medical and preventive attention needed to improve forest workers' quality of life and also makes it impossible to obtain reliable statistics to assess the true state of occupational safety and health in the sector.

The world's countries have not adopted common indicators or criteria for occupational safety and health in the forest sector, making comparison almost impossible. Many countries use incident rate or frequency rate – per 200 000, 500 000, 1 million or other amount of worked hours – to calculate occupational safety levels. In most countries, time lost due to accidents is counted from the third day. But in Argentina it is counted from day 11, while Chile counts lost time from the day of the accident. Employers sometimes hide accidents by sending injured people to work doing light duties or counting them as first-aid cases; in some countries, this alternative is forbidden by law. Finally, some countries include accidents during travel time in their statistics, while others do not.

The number of fatal accidents per million cubic metres of harvested wood is perhaps the only category for which figures can be compared (Table 2).

Standards and regulations developed since the 1990s to reduce the accident rate in forest operations and to contribute to the creation of healthier and safer working environments in the sector include:

- ILO codes of good forest practices promoted (ILO, 1998);
- principles and criteria for worker protection included in criteria and indicators used for certifying sustainable forest management (see Box, left);
- International Organization for Standardization (ISO) standards for quality management (ISO 9001) and environ-

TABLE 2. Fatalities per million cubic metres of wood harvested, 1999 to 2004

Country	All operations	Small-scale operations
Sweden	0.11	0.80
Germany	0.67	2.20
Chile	0.95	–
Austria	1.84	3.60
Switzerland	1.94	–
Slovenia	4.90	–

Sources: Klun and Medved, 2007, cited by Hudson, 2007; ACHS, 2009a.

Principles and criteria for occupational health and safety: some examples

FOREST STEWARDSHIP COUNCIL (FSC)

Principle 4. **Community relations and workers' rights. Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.**

Criterion 4.2. **Forest management should meet or exceed all applicable laws and/or regulations covering health and safety of employees and their families.**

CHILEAN SYSTEM FOR SUSTAINABLE FOREST MANAGEMENT CERTIFICATION (CERTFOR)

Principle 7. **Those responsible for forest management must respect forest workers' direct and indirect rights, compensate them adequately and equitably, safeguarding their health and safety in the workplace.**

Criterion 7.4. **Those responsible for the forest management unit shall safeguard workers' health and safety.**

TABLE 3. Growth in the world population and percentage of older adults between 2000 and 2050

Period	Growth rate of total population (%)	Over age 60	
		% of total population	Annual growth rate (%)
2000	1.6	8.1	3.2
2025	0.9	14.5	3.7
2050	0.2	24.1	1.8

Sources: UN, 2004, cited by Bertranou, 2005.

mental management (ISO 14001), and the subsequent addition of a series of occupational health and safety evaluation criteria (OHSAS 18001).

The combination of these management systems with sustainable forest management regulations can help reduce occupational risks in forests (see Box p. 64).

CHANGES IN THE FOREST-SECTOR WORKFORCE

Ageing

Perhaps the greatest challenge facing forest-sector enterprises in the creation of healthier and safer working conditions is that of adapting to a workforce that is ageing in every part of the world (Table 3). Ageing is a positive trend inasmuch as it is a sign of improved life expectancy as well as improved quality of life increasing the number of old people capable of working (although it is also an outcome of a reduced birth rate). However, greater longevity also entails new social risks, such as destabilization of pensions and other social security protection systems (ILO, 2005b).

It is likely that in most countries, the harsh conditions of forest work contribute to the ageing of the sector's workforce, as fewer young people are motivated to pursue a career in forestry at all levels (engineer, technician and labourer) (van Lierop, 2003).

Women in the workforce

The gradual entrance of women into various forest activities and the woodworking industry has also altered the workforce. Female employees are often preferred for tedious tasks or those requiring delicacy and precision. At the engineer level many women work in research, development and planning, while at the medium and lower levels women are found mainly in jobs involving supervision, risk prevention and tasks involving fine motor skills, such as applied genetics (ACHS, 2009a). In many countries, women are not equally represented in management and decision-making (Blombäck and Poschen, 2003). One of the major challenges facing working women today (and increasingly, working men) is that of combining their working activities with caring for their family and the needs of their personal life (ILO and UNDP, 2009). Some enterprises have improved social benefits and working conditions to address this balance.

FAO/J. CARLE

Women's participation is increasing in forestry work, typically in tasks requiring delicacy and precision, such as applied genetics

CONCLUSIONS

Adequate social security coverage – including attention to risk prevention, health care and economic compensation for the harsh and potentially dangerous working conditions – is fundamental to improving working conditions in forests and timber industries.

Codes of good practices, holistic management systems and sustainable forest management models can contribute to healthier and safer working environments in the world's forests and wood industries.

Where the social status of forest workers is low, its improvement requires systems for training them and for certifying their skills, to make them true forest professionals.

The world's workforce is ageing, and this general trend may be compounded in the forest sector by a lack of motivation for young people to take up a forest career. Social and welfare protection may need to be intensified commensurate with the increase in age index and in the number of dependent older adults.

Women are increasingly finding employment in the sector, particularly in spheres requiring attention to detail. This trend could be encouraged through improved social benefits and working conditions to facilitate a balance between the roles of worker and mother.

A final conclusion is that information on employment in the forest sector must be improved if policies related to safety and working conditions in forests and forest industries are to be improved. ◆

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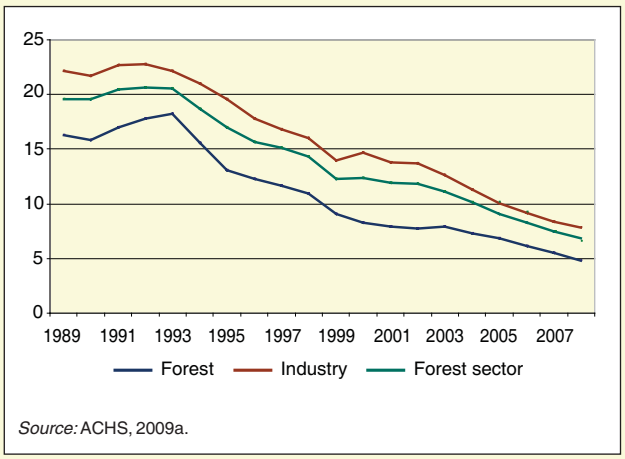
Occupational health and safety in Chile

Some indicators suggest a trend towards improved safety and health in Chile's forest sector. For example, reductions have been observed since 1993 in both the accident rate (relating the number of accidents to the average number of workers) and the loss rate (relating the number of days lost through workplace accidents and work-related disease to the average number of workers) (Figures 1 and 2).

With a view to assessing the impact of sustainable forest management systems on occupational safety and health, the Chilean Safety Association (ACHS), working with the University of la Frontera, monitored 25 forest harvesting enterprises over ten years. Since implementation of ISO 14001 or since adoption of Forest Stewardship Council (FSC) requirements, the enterprises saw significant increases in their competitiveness as a result of improvements in the accident and loss rates and in the average number of days lost through accidents (Ackerknecht *et al.*, 2005).

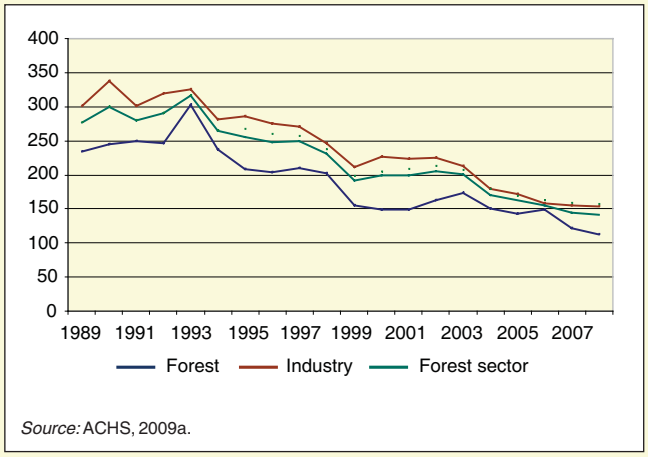
Some change has also been observed in the age of workers suffering accidents in the sector since 1998 (ACHS, 2009b) (Figure 3).



Source: ACHS, 2009a.

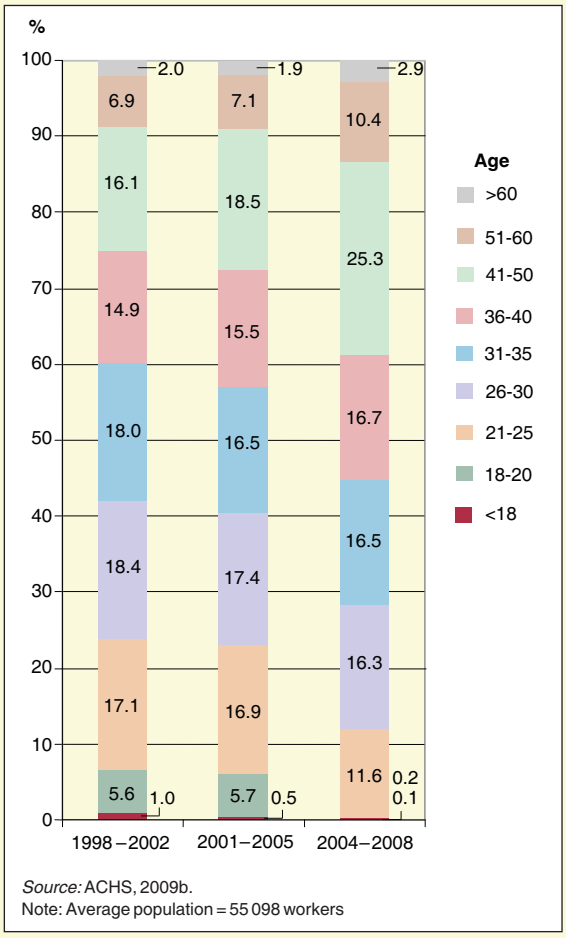
1
Evolution of the accident rate in Chile's forest sector between 1989 and 2008 in 1 892 enterprises belonging to the Chilean Safety Association (ACHS)

2
Evolution of the loss rate in Chile's forest sector between 1989 and 2008 in enterprises belonging to the Chilean Safety Association (ACHS)



Source: ACHS, 2009a.

3
Evolution of the age of workers suffering accidents in forest sector enterprises belonging to the Chilean Safety Association (ACHS)



Source: ACHS, 2009b.
Note: Average population = 55 098 workers

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World forestry at a crossroads: going it alone or joining with others?

H. Savenije and K. van Dijk

Some reflections on forest sector trends, in light of the XIII World Forestry Congress.

The XIII World Forestry Congress was hosted by Argentina from 18 to 23 October 2009. Its theme, "Forests in Development: a Vital Balance", referred to the importance of establishing a sustainable equilibrium not only among the ecological, social and economic functions of forests, but also between forestry and other sectors. Extremely wide-ranging topics – virtually every current forestry issue – were considered during the various plenary sessions, thematic sessions, side events, specialized fora and poster sessions.

The congress was attended by more than 7 000 forestry experts from over 160 countries, representing a wide range of disciplines (technical, social, economic, ecological) and functions (policy-makers, scientists, trade and industry, non-governmental organizations [NGOs], and students). Since the World Forestry Congress is the largest forestry gathering in the world, its findings collectively provide a picture of views and trends in the forest sector. This article identifies some trends perceived by the authors, using as the point of reference their observations from the XII World Forestry Congress, held six years earlier in Canada (see Box). The article concludes with the authors' recommendations for change to ensure the sector's relevance and effectiveness in sustainable development.

TOPICS AND TRENDS

Globalization and social integration of forests continue unabated, and display great dynamism and diversity

Although the congress's Final Declaration states that people are becoming increasingly alienated from forests (because of urbanization, for example), it has become evident that many more people (city dwellers, NGOs, etc.) are becoming stakeholders in those same forests. Forests are increasingly considered as part of a larger whole. Many forest-related problems extend beyond geographic borders, and most are closely interwoven with other issues beyond the forest sector.

The increasing number of claims on forests – economic, social and environmental – and the plurality of stakeholders at all scales (global, national and local), with different and sometimes conflicting interests, values and vocabularies, complicate the play of forces and the decision-making regarding forests, requiring an integrated, coordinated, collaborative approach.

A general shift can be observed in many countries in governance practice and policy-making and in the role and position of central government, i.e. from government to governance. Two tendencies in governance are prominent: a vertical expansion up towards the global and down to the local levels (multilevel governance) and a horizontal expansion to include markets and society (multi-actor governance). Forests are increasingly becoming a societal concern, of interest to others besides foresters.

The vertical and horizontal connections are only developing with difficulty

The connection between international dialogue and local implementation of sustainable forest management has improved little since 2003. The sole change is that regional forestry processes are now encouraged to fill the

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A longer version of this article has previously been published online.

Some trends observed at the XII World Forestry Congress in 2003

In 2003 the authors recorded the following impressions after attending the XII World Forestry Congress in Quebec City, Canada.

Increasing globalization of forestry issues. **Treaties were seen increasingly to shape the broad environmental context for national forest policies and management, but the links to global developments in land use, trade, information and communication technology, urban-rural relationships and institutional and administrative developments were not automatic.**

Social integration of forest management. **The multifunctionality of forests, the multidimensional nature of influences, the plurality of stakeholders and the need to build bridges through partnerships, participation and new alliances were recognized. Forests could no longer be viewed as the exclusive domain and responsibility of the forest sector.**

Global and local: two parallel, separate processes. **Policy-making at the global level had increased, while connections to the local level were decreasing. Locally generated experience was often failing to influence international discussion.**

Forests as an integral component of the landscape**. Increasing interest in a landscape approach to forests was resulting in greater emphasis on intersectoral relationships and the underlying causes of deforestation.**

Strict separation of functions no longer viable**. It had become apparent that strict separation between protected areas and utilization areas was neither tenable nor feasible, and that utilization and protection objectives needed to be achieved as part of sustainability to support livelihoods and combat poverty.**

Importance of good governance and effective institutions**. Good governance, based on democratization, accountability, empowerment, transparency and equitability, was being allocated a more important place in discussion of forests at all levels.**

Shift from valuing forests to increasing financing for sustainable forest management**. Much interest was seen in payment or compensation for environmental functions of forests by the beneficiaries; thus, discussion of the financing of forest management was increasingly shifting away from development cooperation to international cooperation.**

Greater emphasis on partnerships**. The increasing appreciation that the sector cannot "go it alone" was leading to the development of many new types of partnership, for example involving local communities and businesses, or NGOs and businesses. Stakeholders seemed to be finding more common ground and more opportunities for cooperation than in the past.**

gap in communication between the local and international levels and to facilitate national and local implementation of internationally agreed principles.

The effects of other economic sectors on forests are becoming greater, especially those of large-scale agriculture and bioenergy. But while the importance of cross-sectoral relationships and planning continues to be emphasized, in most countries these have improved little if at all. Much is said about integrating forests into landscape approaches and into national policy, and about strengthening the relationships with others that influence (or are influenced by) forests. Yet neither those in the forest sector nor those in other sectors have been able to give effective shape to this integration. The lack of intersectoral connections also applies to international climate discussions, where the forestry community frequently watches from the sidelines and feels to a certain extent excluded from decisions.

The real challenge for the forest sector lies in forging links with other sectors and among various levels.

Growing awareness of the multifunctionality and importance of forests is encouraging, but forest management and protection are still improving too slowly

The greatest threats to forests come from beyond the domain of forestry, arising from the rapidly increasing demand for food, feed and fuel. Given the major predicaments facing humanity – poverty, famine, energy, water, climate change, financial crisis, emergencies, conflicts – and the political and social urgency of tackling them, forests, if seen in isolation from these, easily become a secondary political priority, despite the rhetoric devoted to them.

Despite growing recognition of the importance of protecting forests for their regulatory functions and biodiversity, increasing claims on land and on wood as a raw material (for construction and energy) are leading to greater pressures on forests. Whether an equilibrium can be found among these competing claims, in the form of sustainable, integrated forest management, is open to question, especially because the production functions of forests immediately provide money (whether legally or not), while collective goods such as the regulatory functions of forests are rarely priced and compensated.

Forests and climate: justifiable expectations or just the latest hype?

The topic of forests and climate had little visibility in 2003 and hardly any role at the XII World Forestry Congress, but in 2009 it was of the greatest interest, attracting the largest audiences.

A message formulated by the congress for delivery to the United Nations Climate Change Conference in Copenhagen,

Denmark in December 2009 "note[d] with concern the impacts of climate change on forests and strongly emphasize[d] the important role forests play in climate change mitigation and adaptation as well as the need for forest-dependent people and forest ecosystems to adapt to this challenge". The general message was that forests provide far more than just carbon sequestration.

Reducing emissions from deforestation and forest degradation in developing countries (REDD), in particular, was presented as an opportunity to channel more money into forest protection, forest recovery and other aspects of sustainable forest management. It is clear that the "climate trump card" (or should that be "straw to clutch at"?) has quickly had a positive effect on the overall mood in the forest sector. It has led, in a relatively short time, to new fervour, high expectations and a large number of new initiatives regarding forests and carbon.

Doubts and misgivings have also arisen, however, as to the extent to which these expectations can be met. There are still major problems in technology, methodology and implementation, for example regarding definitions and the monitoring and verification of changes. There are also concerns that a REDD mechanism could be just as complex and unworkable for forests as the Clean Development Mechanism (CDM) was in the past (as evidenced by the dearth of afforestation/reforestation projects under the CDM). Most countries that are candidates for REDD funding do not currently have the institutional capacity to use it effectively. Deforestation and forest degradation remain deeply rooted in macroeconomic, political and institutional conditions, power relations, landownership and poverty; there are no quick solutions to any of these problems.

Forests and energy: a controversial dilemma

Opinions at the congress differed regarding whether rapidly developing industrial demand for renewable sources of energy is good or bad for forests and forestry.

Some predict that future developments in biorefining and bioprocessing technology will lead to major opportunities for bioenergy from forests, including potential for the expansion of intensively managed forest plantations for biomass production.

Others are concerned that the increasing demand for bioenergy, particularly first-generation biofuels, is already bringing about major changes in land use that directly or indirectly threaten forests, for example the conversion of natural forest into plantations for soybean, oil-palm or other rapidly growing biomass crops. Potential social and environmental risks of this type of land-use change were pointed out, including potential impact on soil, water and biodiversity and on the income, property rights and livelihoods of local populations.

Whether bioenergy development will have positive or negative outcomes for forests and forest-dependent people will depend to a great extent on the rules, standards and incentives created for the production of biomass and the effectiveness of their implementation.

What was striking (and perhaps also a warning) was that the congress dealt with issues of forests and energy primarily from an environmental perspective (i.e. as an alternative to fossil-fuel-generated energy) and almost entirely overlooked the socio-economic issues, particularly the ties between fuelwood use and poverty. This remains a dire problem in many countries but has almost entirely disappeared from international development cooperation agendas.

Forest landscape recovery and management of secondary forests should not be neglected

The climate and energy discussion has generated additional interest in the conservation of natural forests and the creation of forest plantations. However, recovery of degraded forest landscapes and effective management of secondary forests are equally important, because forests are often essential components of the landscape on which poor local people depend for their livelihood and culture, and they are also vital for biodiversity (and the recovery of biodiversity) and ecological regulation. Sessions on forest landscape recovery and management of secondary forests concluded that these are two of the main challenges for forestry and require more attention.

What has happened to the interest in community forestry and social forestry?

For many years, participation by local populations in forest management, in the form of community forestry and social forestry, was strongly promoted as the way to sustainable forest management. Although interest in this subject has not actually disappeared, it no longer takes an important place in discussion. For example, projects and programmes concerning the relationship of people and forests in dry areas generated abundant experience in the past, but this issue has been sidelined

The importance of protecting forests for their biodiversity and other environmental services is increasingly recognized

H. SAVENIJE

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Forest landscape recovery is a key challenge, as many poor local people depend on forests for their livelihood and culture

as others – particularly climate change – have attracted more attention.

Valuation of forests is not enough; ultimately, what is needed is a healthy financial basis for management and protection

Financing is increasingly seen as the key to effective management and protection of forests, and there is a great deal of innovative thinking and experimentation in this area. The multifunctionality of forests is emphasized as a basis for generating investment and extra income for forest management. New ideas are also being developed for setting up green national accounts (which incorporate the value of environmental services in economic accounting), within which the actual contribution of forests to the economy and society is quantified.

There is a great deal of interest in payment for ecosystem services (PES), a concept that was still new and unelaborated at the 2003 congress but has now become part of mainstream thinking. Significant experience has been gained, but the many publications on the subject make clear that the PES concept is still under development. Problems that still need to be solved include, for example, how the value of a certain ecosystem service can be quantified, how the price should be determined, who the users are, and how those users should pay for the service. But paying for ecosystem services need not necessarily be done through the market, as is often supposed; in some cases it may involve obligatory payment in the form of a tariff or tax.

Attention is also focusing on new sources of funding, including institutional investors. Many countries, however, are only beginning to tap such sources. One major challenge is how more money can be generated from the capital market (already the most important source) and used in a socially responsible and sustainable manner for forest recovery, management and protection. More than in the past, the forest sector must create a workable link to the financial sector; this involves the two sectors learning "to speak each other's languages" in order to do business together, particularly as regards the provision of formal financing to small producers.

Is certification effective, or does it simply lead to proliferation of standards?

Forest product certification continues to have appeal as a market instrument to promote sustainable management and production, but it has not really taken hold yet for tropical forests (for which the concept was originally developed). Certification processes are still driven by the international market; the concept has barely taken hold in national markets, where the largest quantities of timber and other forest products are sold and where certification could achieve the greatest benefit in terms of sustainable management. Reasons for this limited success include the direct and indirect costs involved in certification, which are not compensated for in prices; the specific requirements set; and above all the lack of policy and institutional preconditions for sustainable forest management.

At the same time, forest managers are confronted by a plethora of new standards and certification or verification schemes, for example for biomass, energy, carbon-dioxide sequestration, fair trade and legality. This proliferation not only may lead to confusion and higher costs for producers and consumers; it also entails the risk of unequal requirements for the various systems. The certification market requires harmonization and coherence if it is to achieve its intended credibility, effectiveness and scope.

The forest and financial sectors must learn more about each other in order to do business together, particularly as regards the provision of formal financing to small producers

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Without good governance and effective institutions, the extent of sustainable forest management will remain limited

Governance was an emerging topic at the 2003 congress, with cautious discussion of corruption, illegality and bad governance. Attention to it has grown, as shown by Forest Law Enforcement and Governance (FLEG) and Forest Law Enforcement, Governance and Trade (FLEGT) processes. Good governance and sound institutions are viewed as the decisive factors for sustainable forest management. Good (or good enough) forest governance is now a generally accepted concept in discussion of forests; this is seen as involving not only trust, transparency and accountability, but also fair and equitable participation and organization of roles, rights, responsibilities and powers among stakeholders and institutions at all levels, and not only in the forest sector. Substantial progress has been made in sustainable production chains, combating illegality, modernizing the forest sector and responsible business activity.

AND THE FUTURE?

The trends observed above suggest that the forest sector must focus, more than in the past, on the outside world and questions and perceptions that are arising there. Currently, the sector focuses inward in its approach to problems and solutions – often viewing other sectors and society at large as the cause of the problems (or lamenting their lack of support and recognition) rather than as partners and facilitators in solving them.

Many of the solutions to forest problems have to come from other sectors, society in general and political circles. Conversely, major functions that properly managed forests can provide to society and the cost of losing forests are often not highlighted sufficiently. The forest sector must adopt a more active, strategic and political position in public debate and must contribute to current political and intersectoral agendas, indicating what it has to offer. Persuasiveness *vis-à-vis* the agricultural sector, the financial sector and political circles in general will be decisive. New agendas, such as that for the world's climate, can bring new opportunities to the forest sector.

However, the necessary skills to operate and communicate strategically are not currently well developed in the forest sector. Investment is needed to develop skills in communicating, managing conflict, achieving consensus and collaborating with others. This entails giving up some of the autonomy (or supposed autonomy) of the sector and learning to accept being only a small part of a larger dimension.

Forestry institutions will need to focus outward, to become service providers that can supply concepts and methods, substantive and policy-oriented forestry expertise and implementation capacity so that forests can deliver the best possible contribution to sustainable development. In this context, it is the task of the forest sector to make clear the value of forests, i.e. the value of all the goods and services they provide, including their role in combating poverty.

The world in 2009 is different for forests than it was in 2003, and it is difficult to predict what the situation will be in 2015 when the next World Forestry Congress will be held. What is certain, however, is that the developments and tendencies sketched here – ongoing globalization and decentralization, social integration, interconnection, complexity, governance changes and increasing competing claims on forests – constitute major challenges for the forest sector and for forestry specialists. The question is how those challenges are to be tackled.

Forestry cannot "go it alone" in isolation from other sectors. In addition to maintaining and guaranteeing substantive expertise, actors in the sector will need to be flexible in their ideas, attitudes and methods if they wish to remain interesting, relevant and effective partners in developing and implementing global and local forestry agendas.

In Buenos Aires, the Director General of the Center for International Forestry Research (CIFOR), Francis Seymour, wondered: "Can we orchestrate good vibrations?", referring to the question of what policy and institutions are necessary so that sustainable forest management has a positive impact on local households and society in general.

The authors believe that this is indeed possible if the forest sector manages to come out of its shell and make progress in connecting and cooperating with other parties, as a fully recognized and equal stakeholder. ◆

Going it alone, or joining with others?

H. SAVENIJE

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New leader for FAO forestry

The FAO Forestry Department welcomes a new head, Assistant Director-General Eduardo Rojas-Briales, effective 1 March 2010.

Rojas-Briales, a Spanish national, comes to FAO from the Faculty of Agronomy of the Polytechnic University of Valencia, Spain, where he was a professor in the M.Sc. programme in Forestry from 2003. In 2004 he was appointed Vice-Dean of the Faculty.

Rojas-Briales holds an M.Sc. degree in Forestry from the University of Freiburg, Germany and a Ph.D. from the Polytechnic University of Madrid, Spain. From 1992 to 1998, he was Director of the Catalan Forest Owners Association. He also served as part-time Professor of Forestry Policy at the University of Lleida, Spain (between 1994 and 2000). From 1996 to 1999 he headed the Forest Policy Area for the Mediterranean Regional Office of the European Forest Institute (EFI), where he was responsible for projects on multifunctional forestry as a means for rural development, on multifunctional forest management and policy for mountainous regions and on national forest programmes. From 1999 to 2003 he did consulting work in forest policy. Earlier in his career, he worked for the forest services of Germany and Catalonia, Spain.

His particular areas of interest and expertise include silviculture, afforestation, forest law, forest policy, national and regional forest programmes, and institutional reform.

Since 1997 Eduardo Rojas-Briales has been on a number of boards and panels, among others the Scientific Advisory Board of EFI from 1998 to 2002.

FAO releases key findings of the Global Forest Resources Assessment 2010

World deforestation, mainly the conversion of tropical forests to agricultural land, has decreased over the past ten years but continues at an alarmingly high rate in many countries, according to the results of the Global Forest Resources Assessment 2010 (FRA 2010), released in March.

FAO's most comprehensive forest review to date indicates that globally, just under 13 million hectares of forests were converted to other uses or lost through natural causes each year in 2000–2010, as compared with close to 16 million hectares per year during the 1990s. The study covers 233 countries and areas. It indicates that the world's total forest area is just over 4 billion hectares or 31 percent of the total land area.

Brazil and Indonesia, which had the highest loss of forests in the 1990s, have significantly reduced their deforestation rates. In addition, ambitious tree planting programmes, especially in China, India, the United States of America and Viet Nam – combined with natural expansion of forests in some regions – have added more than 7 million hectares of new forests annually. The net loss of forest area has thus been reduced to 5.2 million hectares per year in 2000–2010 (an area equivalent to that of Costa Rica), down from 8.3 million hectares per year in the 1990s.

South America and Africa had the highest net annual loss of forests in 2000–2010, with 4.0 and 3.4 million hectares respectively. Oceania also registered a net loss, due partly to severe drought in Australia since 2000.

Asia, on the other hand, registered a net gain of some 2.2 million hectares annually in the last decade, mainly because of large-scale afforestation programmes in a few countries, especially China. However, conversion of forested lands to other uses continued at high rates in many countries in South and Southeast Asia.

In North and Central America, the forest area remained fairly stable, while in Europe it continued to expand, although at a slower rate than previously.

In general, the results are encouraging, showing for the first time that the rate of deforestation has decreased globally through concerted efforts taken at both the local and international levels.

However, the rate of deforestation is still very high in many countries. Primary forests – forests undisturbed by human activity – account for 36 percent of total forest area but have decreased by more than 40 million hectares since 2000. This change is largely due to reclassification of primary forest to "other naturally regenerated forests" because of selective logging or other human interventions.

Other key findings of FRA 2010 include the following:

- The area of forest in national parks, wilderness areas and other legally protected areas has increased by more than 94 million hectares since 1990, now equalling 13 percent of the total forest area.
- Forests – among the world's most important carbon sinks – store some 289 gigatonnes (Gt) of carbon in trees and vegetation. Carbon stocks in forest biomass decreased by an estimated 0.5 Gt per year in 2000–2010, mainly because of a reduction in total forest area.
- Fires, pests and diseases are causing increased damage to forests in some countries. On average, 1 percent of all forests

was reported to be significantly affected each year by forest fires. Outbreaks of forest insects damage some 35 million hectares of forest annually. Extreme weather events such as storms, blizzards and earthquakes also took a heavy toll in the past decade.

- Seventy-six countries have issued or updated their forest policies since 2000, and 69 countries – primarily in Europe and Africa – have enacted or amended their forest laws since 2005.

Data collection for the Global Forest Resources Assessment is becoming more comprehensive and precise. New data and additional information on afforestation and on natural expansion of forests for the past 20 years has made it possible to estimate rates of deforestation and loss from natural causes more accurately. The new global estimate for 1990 to 2000 (close to 16 million hectares per year) is higher than was estimated in FRA 2005 (13 million hectares), because it now also includes deforestation within countries that have had an overall net gain in forest area.

FAO's Global Forest Resources Assessments are published every five years. More than 900 specialists from 178 countries and forest-related international organizations were involved in the Global Forest Resources Assessment 2010. The full report of this assessment will be released in October 2010. In addition, an FAO-led global remote-sensing survey of forests, sampling some 13 500 sites in the world over a 15-year period, will be completed towards late 2011, providing even more accurate information on rates of deforestation, afforestation and natural expansion of forests.

A brochure reporting the key findings is available at: www.fao.org/forestry/fra/fra2010

Reforestation and agroforestry for longer-term recovery in Haiti

The magnitude 7.0 earthquake that struck Haiti on 12 January 2010 was devastating in terms of fatalities, injuries and loss of housing, infrastructure and livelihoods. Recovery will be an enormous undertaking. The United Nations immediately launched a Flash Appeal for US$1.4 billion to cover emergency humanitarian assistance and key early recovery projects until December 2010.

In the longer term, relief efforts will have to focus on "building back better" – ensuring that Haitian institutions are stronger and more resilient than before, and that the most vulnerable people are protected. With more than 65 percent of Haitians engaged primarily in agriculture, FAO has already begun to provide seeds, fertilizer and tools, aiming to reach 180 000 smallholder farming families.

Forestry will have a key role in improving the country's low agricultural productivity. Over time, Haiti has suffered from loss of fertile soils and potential farmlands as a result of heavy deforestation and poor watershed management, which have caused severe soil erosion and vulnerability to flooding from frequent tropical storms and hurricanes. Some 95 percent of Haiti's original forests have been destroyed; nearly 10 percent of the country's forest cover (11 000 ha) was lost between 1990 and 2005.

The earthquake creates a risk of even greater deforestation as displaced residents of Port-au-Prince, seeking food and shelter in the countryside, are likely to cut remaining trees as a source of energy and construction material.

The restoration of the protective and productive functions of forests through reforestation and agroforestry on the barren hills of Haiti will play a critical role to prevent soil erosion and landslides, protect downstream agricultural production and act as a protective buffer to regulate the quantity and quality of water to downstream communities, agriculture and fisheries. FAO considers upland reforestation and agroforestry as urgent priorities, as any initiatives in downstream rural areas and cities can be destroyed without related upstream integrated watershed management. FAO has developed project proposals on reforestation and agroforestry which are to be presented for funding at the International Donors' Conference "Towards a New Future for Haiti" in New York on 31 March 2010. The conference has been organized by the United Nations Office of the Special Envoy for Haiti to mobilize international support to lay the foundation for Haiti's long-term recovery.

The proposed reforestation programme includes targeted measures to protect reforested areas from overexploitation for fuelwood and charcoal to ensure the sustainable long-term rehabilitation of Haiti.

FAO has also launched the initiative "Fruit Trees for Haiti" in support of the Haitian Government's campaign to plant 10 million trees. FAO Director-General Jacques Diouf, during a four-day visit to the country in March, noted that a significant increase in national food production, rural employment and reforestation are the keys to a greener, more productive Haiti. The FAO initiative focuses on providing fast-growing fruit trees for school gardens. Later other tree species will be included. A mere US$5 donation will buy an avocado or mango tree for a Haitian school garden, and covers fertilizer and other inputs as well as educational material to build awareness of the role of trees in protecting the environment and reducing risks from hurricanes, flooding and erosion. For more information, or to contribute, see: getinvolved-donate.fao.org

FAO and CPF investigate measurement of forest degradation

Rates of deforestation and forest loss are regularly measured, but forest degradation is harder to measure, even though it is similarly important. Many recent environmental goals and initiatives rely on measurement of forest degradation – including the first Global

Objective of the United Nations Forum on Forests, climate change initiatives for reducing emissions from deforestation and forest degradation (REDD) in developing countries, and the 2010 Biodiversity Target of the Convention on Biological Diversity.

International forest-related organizations have defined forest degradation as the reduction of the capacity of a forest to provide goods and services. Beyond this core definition, however, perceptions regarding forest degradation are many and varied, depending on the driver of degradation and the main point of interest – biodiversity conservation, carbon sequestration, wood production, soil conservation or recreation, for example. In the absence of agreed definitions and assessment methods, few countries are currently able to report on the area of degraded forests or the degree of forest degradation.

FAO and other members of the Collaborative Partnership on Forests (CPF), together with other partners, are undertaking a special study to identify the elements of forest degradation and the best practices for assessing them. The main objective of the study, which is carried out under the umbrella of the Global Forest Resources Assessment 2010 (FRA 2010), is to help strengthen the capacity of countries to assess, monitor and report on forest degradation by:

- identifying specific elements and indicators of forest degradation and degraded forests;
- classifying elements and harmonizing definitions;
- identifying and describing existing and promising assessment methodologies;
- developing assessment tools and guidelines.

Forests may be degraded in terms of loss of any of the goods and services that they provide (fibre, food, habitat, water, carbon storage and other protective, socio-economic and cultural values). By using the seven thematic elements of sustainable forest management, the study will identify suitable indicators to assess the degree of degradation of a forest at different management levels.

The study approach includes a survey of existing country practices to see what is being measured; an analytical study on definitions to provide a framework for the process; and a series of case studies to describe proven or promising methodologies and tools for assessing different aspects of forest degradation.

From 8 to 10 September 2009 a technical meeting was held at FAO headquarters in Rome to review the results and to recommend actions to improve measurement, assessment and reporting on forest degradation. Participants included all the contributors to the study and representatives of international agencies.

The case studies and an analysis of definitions of forest degradation were presented and discussed. Working groups then discussed indicators of degradation and proven and promising assessment methodologies in more detail. A session was also held on forest degradation and climate change.

Among its main outcomes, the meeting endorsed a generic definition of “forest degradation” as a reduction in the capacity of a forest to provide goods and services, and noted that this definition provides a framework for developing more specific definitions for particular purposes. Participants also called for:

- improved communication of the many different aspects of forest degradation to climate change negotiators;
- focused attention on harmonization of definitions and methods for monitoring five aspects of forest degradation: stocking level, biodiversity, forest health, level of use/production and forest soil;
- the inclusion of forest degradation in terms of climate change into the proposed mechanism for reducing emissions from deforestation and forest degradation (REDD), since methodologies do exist to monitor changes in carbon stocks;
- the development of tools and guidelines for measuring different aspects of forest degradation.

Further information is available at: www.fao.org/forestry/degradation-cpf

Growing visibility for forests in climate discussions

Good progress was made on forest issues at the climate change meetings held in Copenhagen, Denmark from 7 to 18 December 2009, even though the outcomes were generally disappointing in most other respects.

At the fifteenth session of the Conference of the Parties (COP 15) to the United Nations Framework Convention on Climate Change (UNFCCC), the two ad hoc bodies tasked with delivering a follow-up to the Kyoto Protocol and agreement on further action under the convention – the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP) and the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) – were unable to conclude their work, and their terms were extended. The Copenhagen Accord was "noted" but not approved. Parties agreed to notify the UNFCCC Secretariat of their wish to associate with the accord and their mitigation targets or activities by 31 January 2010.

The Copenhagen Accord recognizes the importance of holding the increase in global temperature to 2°C. However, no aggregate emission reduction commitments were agreed. Countries pledged funding of US$30 billion for the 2010–2012 period and up to US$100 billion a year from 2020. The accord called for the establishment of the Copenhagen Green Climate Fund.

The Copenhagen Accord includes the following text on reducing emissions from deforestation and forest degradation (REDD): "We recognize the crucial role of reducing emissions from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries."

During the meetings, six countries (Australia, France, Japan, Norway, the United Kingdom and the United States of America) collectively agreed to dedicate US$3.5 billion "as initial public finance towards slowing, halting and eventually reversing deforestation in developing countries".

The COP adopted a decision on methodological guidance for REDD-plus (covering REDD plus conservation, sustainable management of forests and enhancement of forest stocks). The decision, reflecting the outcome of several years of work under UNFCCC's Subsidiary Body for Scientific and Technological Advice (SBSTA), requests Parties to identify drivers of deforestation and forest degradation; to identify REDD-plus actions to take; to use the most recent Intergovernment Panel on Climate Change (IPCC) guidance and guidelines for carbon accounting; to establish national forest monitoring systems; and to engage indigenous people and local communities in monitoring and reporting. It also calls for stronger capacity building and increased coordination of support.

Good progress was made on negotiations on policy approaches and positive incentives in REDD-plus in the AWG-LCA discussions. The draft text outlines principles, safeguards, scope and a phased approach for implementing REDD-plus actions under a UNFCCC instrument. It requests SBSTA to identify drivers of deforestation and to work on methodologies to estimate emissions and removals and assess mitigation potential, and calls for coordination of REDD-plus activities among those supporting them. Issues still to be resolved include national versus subnational approaches to REDD-plus; measurement, reporting and verification of developed country support; the relationship between REDD-plus and nationally appropriate mitigation actions (NAMAs); and the financing modality (fund versus market-based or mixed).

Negotiations of AWG-KP on land use, land use change and forestry (LULUCF) in industrialized (Annex 1) countries addressed the rules relating to accounting of greenhouse gas emissions and removals. Key issues include accounting for forest management activities and for carbon in harvested wood products. AWG-KP also discussed the proposal to broaden the scope of activities eligible for Clean Development Mechanism (CDM) projects. The draft text calls on SBSTA to begin exploring ways to move towards more comprehensive accounting of greenhouse gas emissions and removals by sinks by LULUCF activities.

Regarding adaptation, the draft AWG-LCA text calls for a Copenhagen adaptation framework or programme, under which action would be initiated by countries. Aspects that remain undecided, however, include institutional structures (new versus existing) and the establishment of an insurance mechanism for climate change–induced losses. Agreement seemed clear on the need for enhanced regional cooperation on adaptation, and the draft AWG-LCA text calls for establishment of regional adaptation "centres" or "platforms".

On 13 December 2009, the Government of Denmark and the Centre for International Forestry Research (CIFOR) with the other members of the Collaborative Partnership on Forests (CPF) co-hosted Forest Day 3, attended by 1 600 participants. It included three subplenary sessions (on mitigation, adaptation and forest degradation) and eight parallel learning events. This Forest Day, as did the previous two, provided an opportunity to extend messages from the forestry community to the UNFCCC discussions.

Though inconclusive, the Copenhagen meetings were significant for the forest sector. Political visibility for forests is at an all-time high. The focus on adaptation and mitigation has become more balanced. It appears likely that REDD-plus funding could increase dramatically in the short term; as a consequence, capacity strengthening for developing countries will take on increased urgency. Proposed changes related to LULUCF accounting and offset rules have the potential to improve forest management and increase forest-based mitigation in developed countries as well.

International Year of Biodiversity

As many as 13 million different living species, including plants, animals and bacteria, share the earth; only 1.75 million of these have been named and recorded. This incredible natural wealth is a priceless treasure forming the ultimate foundation of human well-being.

Safeguarding biodiversity and reducing biodiversity loss are vital for current and future human well-being. To raise global awareness and increase understanding of the crucial role that biodiversity plays in sustaining life on Earth, the United Nations has proclaimed 2010 as the International Year of Biodiversity. At the official launch of the year on 11 January 2010, United Nations Secretary-General Ban Ki-moon proclaimed the need for a new biodiversity vision and called upon every country and every citizen of the planet to engage in a global alliance to protect life on earth.

The celebrations for the International Year of Biodiversity are led by the Secretariat of the Convention on Biological Diversity (CBD), with numerous partners. Throughout the year countless initiatives will be organized to disseminate information, promote the protection of biodiversity and encourage organizations, institutions, companies and individuals to take direct action to reduce the constant loss of biological diversity worldwide.

Under the slogan "Biodiversity is life. Biodiversity is our life", the celebration of the year draws attention to four key messages:

- Humans are part of nature's rich diversity and have the power to protect or destroy it.
- Biodiversity, the variety of life on earth, is essential to sustaining the living networks and systems that provide all people with health, wealth, food, fuel and the vital services that their lives depend on.
- Human activities – felling or burning of forests, removal of mangroves, intensive farming, pollution stress, overfishing and the impacts of climate change – are causing the diversity of life on earth to be lost at a greatly accelerated rate. These losses are irreversible, impoverish everyone and damage the life support systems people rely on every day. But they can be prevented.
- The International Year of Biodiversity provides an occasion to reflect on prior achievements to safeguard biodiversity and to focus on the urgency of challenges for the future. The International Year of Biodiversity is a chance to prove the will to stop the losses.

For more information, see: www.cbd.int/2010

Second World Congress of Agroforestry

In tropical countries, agricultural expansion is often a cause of deforestation. But farming and forests do not have to be mutually exclusive. Agroforestry has a key role in addressing the challenges of food security that are inevitable with the world's rapid population growth, while contributing to rural livelihood improvement and delivering a wide range of benefits including increased soil fertility, absorption of atmospheric carbon and restoration of degraded land.

The science and practice of agroforestry offer useful directions in solving the problem of how to feed a growing population while protecting the environment. Forests and trees in agricultural landscapes are central to sustainable agriculture. The practice of conservation agriculture and increasing tree cover on farms can also offer prospects to smallholder farmers for diversifying livelihoods and incomes via emerging carbon markets.

"Agroforestry, the future of global land use" was the theme of the second World Congress of Agroforestry, cohosted by the World Agroforestry Centre (ICRAF) and the United Nations Environment Programme (UNEP) in Nairobi, Kenya from 23 to 28 August 2009. The congress attracted almost 1 200 researchers, educators, practitioners and policy-makers from around the world, who came to share new research ideas and experiences, explore partnership opportunities and strengthen communities of practice, while strengthening links between science and policy.

The congress had three subthemes: food security and livelihoods; conservation and rehabilitation of natural resources; and policies and institutions.

A clear message that came out of the congress was that over the past 30 years, agroforestry has matured into a robust, science-based discipline, and a land use that can address many of the world's most pressing problems.

The question therefore arises of why, although the number of trees on farms is steadily increasing, agroforestry is not being adopted more widely and rapidly. The congress attributed this in part to the failure of agroforesters to communicate the benefits of agroforestry in a compelling and intelligible way to policy-makers, politicians and the public. The importance of good public relations was highlighted.

In the Congress Declaration, the participants expressed their belief that widespread scaling-up of agroforestry innovations during the next decade could greatly facilitate the success of global commitments and conventions such as the United Nations Millennium Development Goals and the conventions on biological diversity, climate change and combating desertification. The declaration included the following proposals:

- vigorous development of cross-sectoral policy and institutional frameworks that support agroforestry at regional and national levels in the context of development strategies and multilateral environmental agreements;
- enhanced public and private investment in agroforestry initiatives, including research, education and development;
- accelerated development of methodologies for measuring, valuing and monitoring ecosystem services provided by agroforestry;
- enhanced research and development in tree domestication, genetic improvement, use of biotic resources and value adding to agroforestry products at all levels;

- expansion of choices available for women and vulnerable groups to further increase their access to land and tree-based products and services;
- concerted efforts to popularize the deployment of agroforestry through an integrated, interdisciplinary, multi-institutional and multistakeholder approach;
- improved communication about the benefits of agroforestry for social, economic, cultural, ecological and environmental sustainability;
- increased recognition of agroforestry as an important area of investment for land rehabilitation, biodiversity conservation, climate change mitigation and adaptation, and improved food and nutritional security.

Further information is available at: www.worldagroforestry.org/WCA2009

Ambitious mangrove afforestation programme in Oman

Oman has intensified its mangrove afforestation programme over the past several years, in the wake of hard evidence of the vital coastal protection that mangroves provide. The tropical cyclone Gonu devastated large areas on the coast of Oman in June 2007, leaving 70 people dead. It also damaged parts of the mangrove forests around the capital and in the Qurum ("mangrove") area of the city. But the surviving mangrove forests protected the coastal areas against the tidal waves, flooding and inland intrusion of salt water.

Oman has 1 700 km of coastline, which was densely covered by mangroves in ancient times. Human activities – cattle herding, fuelwood collection, building and agriculture – reduced these forests to some isolated areas around lagoons, inlets, tidal channels and islands. The Marine Environmental Conservation Department in the Ministry of Environment started a mangrove conservation programme in 2000 with support from the Japan International Cooperation Agency (JICA). A master plan for mangrove afforestation was drafted in 2002. JICA also helped establish Oman's first permanent, pump-irrigated mangrove nursery in Qurum, and provided the first 11 000 seedlings.

Today there are four nurseries, both pump irrigated and tidal irrigated, and the planting and soil preparation work continues. In connection with the JICA aid, over 250 000 seedling pots were planted. After that, the Omanis continued the work. Between 2000 and spring 2009, over 418 000 transplantable seeds had been raised in the four nurseries. Trees have been planted all along the coast wherever possible. Some of the plantations have now become self-seeding. In the coastal area, there are at present only some 1 000 ha of mangrove forests, but much more can be created. The most common mangrove species in Oman is *Avicennia marina*, which is also the dominant species along the coasts of the Arabian Gulf and the Red Sea.

L. DAMMERT

Strict laws, or royal decrees, now protect the existing forests and suitable areas. The development of tourism, for instance, is not allowed to disturb mangrove forests. Only careful ecotourism such as birdwatching is allowed on a small scale. Any coastal development must be at least 50 m above the highest tide and 150 m from any lagoon.

Education and awareness raising for the population is a very important part of the mangrove afforestation strategy. The importance of mangroves is stressed in newspapers, magazines and posters. Schools provide regular environmental education for children. The Omani Women's Association is very active in this field.

One of the areas identified for immediate transplantation of mangroves is the island of Mahout, located about 400 km south of Muscat, which is the seat of the Sultanate's shrimp fishery centre. The Omanis hope that fishing will generate income in the post-oil years. In recent years, the catches of economically valued species have all declined significantly through overfishing (including fishing by foreign vessels) and reduction in mangroves. Sustainable fisheries, however, have great potential, and the mangrove forests play an important part in efforts to conserve and develop the fish stocks in the country's rich fishing grounds. Mangroves in the Qurum Reserve and Mahout are nursery grounds for juveniles of many commercial fish, including mullet, milkfish, snapper and sea bream.

L. Dammert *(lauri.dammert@umpihankimedia.fi)*

Science training workshop seeks to integrate new concepts into Congo Basin forest management

The Congo Basin holds the second largest primary tropical forest in the world. Home to an immense biodiversity, the Congo Basin forest is a source of subsistence for local populations, and of income and wealth to the region through the export of wood and non-wood products. At the regional scale, the Congo Basin forest influences climate through its contribution to the hydrological cycle. At the global scale, this forest basin mitigates climate change by sequestering carbon in its biomass.

At the start of the twenty-first century, the Congo Basin forest is under a double threat. The first, more apparent, comes from the direct pressure of human activities. The second and less apparent threat is linked to climate and global changes and the ensuing perturbations to the ecosystem dynamics of this forest, including the century-long equilibrium with the extensive human use of its resources.

Within this context, the École Nationale des Eaux et Forêts (ENEF, Gabon) and Université Laval organized the subregional science training workshop Linking Ecoagriculture, Ecoforestry, Biodiversity and Climate Change in the Congo Basin, held in Libreville, Gabon from 4 to 8 January 2010, for researchers and teachers involved in forestry training in the Congo Basin subregion at the university and technical levels. Over 50 participants from Canada, Cameroon, the Democratic Republic of the Congo and Gabon, including specialists, researchers, teachers and high-level civil servants, examined the linkages between ecoagriculture, ecoforestry, biodiversity and climate change, as well as issues related to the conservation and ecosystem management of Congo Basin forests. The workshop also covered issues related to the Clean Development Mechanism (CDM) and reducing deforestation and forest degradation (REDD), as well as socio-economic and cultural aspects of sustainable forest management.

As part of its outputs, the workshop produced recommendations to the Network of Central African Forestry and Environmental Training Institutions (RIFFEAC) for the inclusion of new concepts into the curriculum. Recommendations were also produced for the Central African Forest Commission (COMIFAC) and for national governments for the inclusion of biodiversity and climate change concerns in subregional priorities. Finally, the workshop enabled the establishment of strong scientific collaborations between Canadian and Congo Basin researchers on the practice of ecoforestry and ecoagriculture and on the adaptation to climate change.

This workshop was held as part of the project “Appui à la Formation en Gestion des Ressources Naturelles dans le Bassin du Congo”, financed by the Canadian International Development Agency (CIDA). The project has as its objective to increase the number of trained specialists in tropical ecoforestry and ecoagriculture in the subregion in order to help meet the twenty-first century challenges in the management of natural resources in the Congo Basin.

The workshop was also supported by the Center for Forest Research (Canada), Natural Resources Canada and the German Agency for Technical Cooperation (GTZ).

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Managing conflicts between people and wildlife

Human-wildlife conflict in Africa – causes, consequences and management strategies. F. Lamarque, J. Anderson, R. Fergusson, M. Lagrange, Y. Osei-Owusu & L. Bakker. 2009. FAO Forestry Paper No. 157. Rome, FAO. ISBN 978-92-5-106372-9.

Conflicts between humans and wildlife have occurred since the dawn of humanity. Impacts include human injuries and deaths, crop destruction, attacks on domestic animals, transmission of disease to livestock or humans, and threats to other plant and animal species (particularly those that are endangered or highly valuable).

While smaller animals present in vast numbers, such as birds, grasscutters and locusts, may actually have greater impact, the larger herbivores (elephants, buffalo and hippopotamus), mammalian carnivores (lions, leopards, cheetahs, spotted hyenas and wild dogs) and crocodiles are generally seen as more threatening to humans and are the focus of this book.

This book presents the issues, describes many different methods of conflict management and outlines a three-step framework for decision-making. After a global introduction, the text focuses on Africa, where human-wildlife conflicts are particularly prevalent. And they have become more frequent and severe over recent decades as a result of human population growth, extension of transport routes and expansion of agricultural and industrial activities, which together have led to increased human encroachment on previously wild and uninhabited areas.

Human-wildlife conflict exists in one form or another all over the world. Thus this publication will be of interest beyond Africa. Its audience will include wildlife practitioners, development workers and researchers, local, regional and national authorities, and ultimately anybody keen to learn more about the issue.

Promoting non-wood forest products to diversify farmers' livelihoods

Non-farm income from non-wood forest products. E. Marshall & C. Chandrasekharan. 2009. FAO Diversification Booklet No. 12. Rome, FAO. ISBN 978-92-5-106140-4.

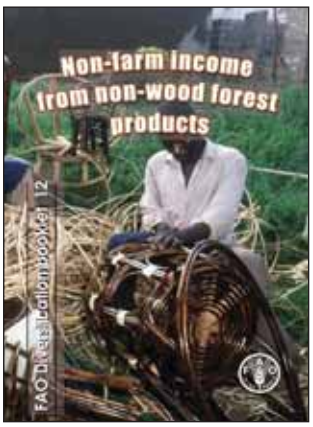
This short publication, aimed at people and organizations that provide advisory, business and technical support services to resource-poor small-scale farmers and local communities in low- and middle-income countries, is intended to raise awareness about rural livelihood opportunities arising from non-wood forest products (NWFPs). It explores the sustainable and complementary contribution that NWFPs can make to livelihoods through subsistence and trade, and provides advice about how the right support and services can help promote NWFPs as a successful livelihood option. It examines the potential benefits, farmer requirements and constraints, and critical success factors in NWFP-based activities.

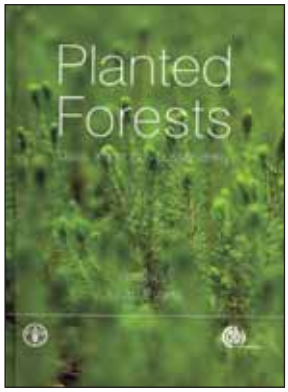
An introduction outlining the history of NWFPs, their current status and their role in improving rural livelihoods is followed by an overview of the many NWFPs and their principal uses. Subsequent chapters address NWFP assets for sustainable livelihoods – natural, social, human, physical and financial – and NWFP value chains, covering stages from production to harvesting, post-harvest, transport, processing and marketing.

The publication next examines strategies for successful NWFP trade. This chapter explores sustainable management of the natural resources; social assets and personal skills for successful trade; value chain analysis; improving physical access, transport and communication; support and services to help promote NWFPs; and policy, assistance and extension.

The FAO Diversification Booklet series profiles farm or non-farm enterprises that can be integrated into small farms to increase incomes and enhance livelihoods, based on their suitability in terms of resource requirements, costs, exposure to risk and complexity. Most volumes emphasize products or services aimed at local markets. However, the present booklet also considers export markets, because international market demand for NWFPs influences small enterprise development and local markets.

In addition to helping service providers support small-scale farmers in exploring new opportunities, this publication also suggests actions that policy-makers and programme managers in government and non-governmental organizations can take to help create enabling environments for small-scale farmers to diversify their income-generating activities.





Current issues for planted forests

Planted forests – uses, impacts and sustainability. J. Evans, ed. 2009. Wallingford, UK, CAB International (CABI) & FAO. ISBN 978-92-5-106222-7 (FAO), 978-1 84593 564 1 (CABI).

Although planted forests make up only 7 percent of the world's forest resources, they have superseded naturally regenerating forests as the principal source of industrial wood products. Representing a complement, not an alternative, to natural forests, planted forests have become increasingly important for reversing deforestation, forest ecosystem loss and forest degradation.

This book provides a synthesis of the uses, impacts and sustainability of planted forests, beginning with their history and looking forward to their potential for the future. It considers management objectives for their use and aspects of ownership and policy, addressing questions such as: Can planted forests help mitigate climate change? Do they adversely affect hydrology? How will they contribute to bioenergy production in the future? What is their role in biodiversity conservation?

A chapter on definitions probes the continuum of forests (and trees outside forests) managed with different levels of intensity and for different objectives (productive or protective). Other chapters summarize recent FAO studies on the current state of planted forests and the outlook to 2030.

The publication emphasizes the multiple roles of planted forests – economic, social, environmental and ecological. These include production of wood, fibre and fuel; soil and water protection; climate change mitigation; and landscape restoration and site reclamation. A chapter on policy, institutional and ownership issues highlights private-sector and smallholder considerations from an investment perspective. Finally, a chapter on sustainable silviculture and management reviews the impact of planted forests on soils, nutrient balance, insect pest and disease threats and site changes, as well as invasive species risks. Management interventions to minimize risks are suggested.

This book will be an essential resource for forestry researchers, policy-makers, planners and all concerned with land use and the environment. To order, see: www.cabi.org/CABIPages/bk_BookDisplay.asp?PID=2192

Implications of forest governance reform in Africa

Governing Africa's forests in a globalized world. L.A. German, A. Karsenty & A.-M. Tiani, eds. 2010. London, UK, Earthscan. ISBN 978-1-84407-756-4.

Many countries in Africa, as elsewhere in the world, are engaged in processes to decentralize forest management. Yet most African countries continue to face serious problems of forest governance, from inequitable benefit sharing to unsustainable forest management and illegal activities. This book summarizes experiences and outcomes of decentralization to date and explores the viability of different governance instruments in the context of expanding commercial pressures on forests.

After an introductory section framing the evolution of forest governance in Africa, Part II addresses the different forms and outcomes of decentralized forest management, emphasizing livelihoods, sustainability of natural resource use, gender issues, participation and distribution of benefits. Specific cases are presented from Cameroon, the Democratic Republic of the Congo, Madagascar, Mali, Senegal, South Africa, Uganda, the United Republic of Tanzania and Zimbabwe.

Part III addresses the implications of forest sector governance reforms for international trade and finance. The first two chapters analyse experiences in Ghana and Tanzania. Additional chapters consider the African Forest Law Enforcement and Governance (AFLEG) and Forest Law Enforcement, Governance and Trade (FLEGT) processes; business networks in the African forest sector; and implications of climate change for forest governance.

This book builds on earlier volumes exploring different dimensions of decentralization and perspectives from other regions of the world. It examines dimensions of forest governance that are both unique to Africa and representative of broader global patterns. The authors conclude by drawing out implications of their findings for policy and practice.

This volume will be of interest to policy- and decision-makers at all levels – local, national, regional and global – and to anyone concerned with the state of forestry in Africa.

Connecting forest certification and fair trade to support community producers

Distinguishing community forest products in the market: industrial demand for a mechanism that brings together forest certification and fair trade. D. Macqueen, A. Dufey, A.P. Cota Gomes, N. Sanchez Hidalgo, M.R. Nouer, R. Pasos, L.A. Argüelles Suárez, V. Subendranathan, Z.H. García Trujillo, S. Vermeulen, M. de Almeida Voivodic & E. Wilson. 2008. Small and Medium Forestry Enterprise No. 22. Edinburgh, UK, International Institute for Environment and Development (IIED). ISBN 978-1-84369-682-7.

Evidence increasingly shows that small forest enterprises, especially those democratically managed by communities, have more potential for reducing poverty than large-scale commercial forestry, even though policy and practice often favour the latter. However, voluntary market mechanisms such as certification have not yet helped community enterprises on a significant scale. Community forest producers must match what the buyer wants, often in competition with other more powerful, better informed and better financed enterprises. This report asks whether it might be possible to develop a mechanism to bring together forest certification and fair trade in the timber market, to enable ethical consumers to distinguish responsibly produced community forest products in the market so as to open up new market niches in support of small forest enterprise.

The publication first describes the results of an international demand survey of timber buyers in 21 countries. It showed that of more than 180 companies known for their social or environmental interest, over two-thirds were interested in principle in the idea of distinguishing community forest products in the market. Their interest was mainly based on increasing customer demand for knowledge about the sustainability of fair trade timber items.

Next, the publication presents four case studies on the demand for community forest products in Brazil, Guatemala, Mexico and Papua New Guinea, based on literature reviews and interviews along value chains involving community forest producers. In each country, one value chain was reviewed in more detail, to determine whether and how a mechanism to distinguish community forest products might be developed for the benefit of those involved.

The report concludes that there does seem to be significant demand for a mechanism to credibly distinguish community forest products in the market, both from international and national buyer groups and from community forest producers. The experiences described in this publication suggest that the main prerequisites for successful trade with communities include the formation of strong community business organizations and the stepwise development of community forest management and business capacity. The experience of the fair trade movement in addressing these issues makes it logical to build better links between forestry and fair trade.

Links between forests and human health

Human health and forests – a global overview of issues, practice and policy. C.J.P. Colfer, ed. 2008. People and Plants International Conservation Series. London, UK, Earthscan. ISBN 978-1-84407-532-4.

The relationship between the health of the world's forests and the health of the hundreds of millions of people who live and work in them is a topic that researchers have only recently begun to examine. This book is a comprehensive introduction to the issues surrounding the health of people living in and around forests, particularly in Asia, South America and Africa.

Part I presents a set of policy, public health, environmental conservation and ecological perspectives on health and forests. Chapters focus on medicinal plants, nutrition, woodfuel, women's and children's health, and tropical forest diseases such as Ebola, Nipah encephalitis and malaria. Part II features four case studies: on the links between HIV/AIDS and the forest sector; on forest disturbance and health risk to the Yanomani in the Amazon region; on biodiversity, environment and health issues among rainforest dwellers around the world; and on links between diet and health. Part III looks at the specific challenges to health care delivery in forested areas, including remoteness and the integration of traditional medicine with modern health care.

The book concludes with a synthesis designed to enable practitioners and policy-makers to work with forest dwellers to improve their health and their ecosystems.

This publication will be a vital addition to the knowledge base of professionals, academics and students working on forests, natural resources management, health and development worldwide.