

ITTO Tropical Forest

UPDATE

A newsletter from the International Tropical Timber Organization to promote the conservation and sustainable development of tropical forests



Putting a brake on wildfire

The huge fires that burned in Borneo in the early 1980s rang alarm bells among tropical forest managers and fire experts. Moist tropical forests, once thought immune to devastating wildfire, were going up in smoke, with huge negative effects on human health and forest sustainability. Heavy rains finally extinguished the fires, and ITTO launched a programme aimed at encouraging integrated, community-based approaches to tropical forest fire management.

This edition of the *TFU* looks at the development of fire management in tropical forests since the 1980s, including through some of ITTO's fire-related initiatives. As the Global Fire Monitoring Center's Johann Goldammer notes in his article (page 3), ITTO's work in assessing the damage caused by the 1982/83 fires in East Kalimantan led to the

Inside: Integrated fire management in Benin, Brazil, Ghana, Guatemala, Indonesia and Panama; guide to carbon benefits in forestry projects



ITTO's proactive approach to fire management.....	3
Indonesia's efforts to improve forest fire management.....	6
Brazil's evolving approach to fire.....	9
Awareness and vigilance reduce forest fire in Benin.....	12
Engaging rural communities in fire management.....	14
Community buy-in to fire management.....	17
Forest fire management in Ghana.....	20
Quantifying the carbon benefits of forestry activities.....	23
Market trends.....	27
Topical and tropical.....	30
Recent editions.....	31
Meetings.....	32



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Design DesignOne
Printing/distribution Print Provider Aps (Denmark)

The *Tropical Forest Update* is published quarterly in English, French and Spanish by the International Tropical Timber Organization. Content does not necessarily reflect the views or policies of ITTO. Articles may be reprinted without charge provided the *TFU* and author are credited. The editor should be sent a copy of the publication.

Printed on METAPAPER SILK RECYCLING, FSC-certified (mixed-sources), 100% recycled and CO₂ compensated paper stock. Printed using vegetable-based soya inks. All METAPAPER papers are produced with an average of 74.66% of renewable energies.

The *TFU* is distributed **free of charge** to over 15 000 individuals and organizations in more than 160 countries. To receive it, send your full address to the editor. Please notify us if you change address. The *TFU* is also available online at www.itto.int.

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Images: A firefighter supervises a controlled burn in Guatemala as part of the country's integrated forest management approach (cover). *Photo: C. Gómez.*

Above: A forest community receives training on integrated fire management during a controlled burn in Chiquimala, Guatemala. *Photo: C. Gomez*

development of globally applicable guidelines on fire management in tropical forests and a project programme on fire management in ITTO member countries. Dr Goldammer, who played a leading role in developing the guidelines, concludes, in his article, that “ITTO projects have established models to support the building of national-to-local fire management capabilities in several ITTO member countries in Africa, Asia and Latin America”.¹

Bambang Hero Saharjo (page 6) recaps the process to develop a more sustainable approach to fire management in Indonesia after the Borneo fires, including through an ITTO project that helped trained more than 15 000 people in forest fire management. Forest fire management remains problematic in Indonesia, however, with large, polluting fires burning in Kalimantan, Riau and Sumatra in early 2015. More capacity is needed to enforce integrated fire management (IFM) approaches, especially at the decentralized government level.

Laura Steil (page 9) reports that the fire management regime in Brazil is moving from a paradigm in which fire must be prevented at all costs to one in which fire is perceived as a natural part of certain ecosystems and can and should be integrated into land-management regimes. On the other hand, fire is over-used in some ecosystems, and alternatives to fire in agricultural production are being pursued.

Achille Orphée Lokossou and Clément Kouchadé (page 12) report on a strategy for preventing or minimizing fires in state-owned plantations and the Lama Forest Reserve in Benin that involves, among other things, raising awareness in villages near the forests about the damage that uncontrolled fires can cause to forests, soils and local economies.

Carlos Gómez (page 14) reports that Guatemala is pursuing IFM based on an improved understanding of, among other things, fire ecology, socioeconomic factors that affect fire regimes, and the role of local communities as participants and decision-makers in community forest management. An ITTO project there sought to support local communities in four regions of Guatemala to develop IFM approaches.

ITTO is a member of the South Korea Conference Organizing Committee and the International Liaison Committee for the organization of the 6th International Wildland Fire Conference, which will be held on 12–16 October 2015. It will convene a side-event there on 15 October to highlight the Organization's field work on IFM in the tropics.

Eyda Estrada and Matilde Barrios (page 17) describe an ITTO project that has helped improve fire management practices in pilot areas to mitigate the negative impacts of fire and to use fire to support natural resource conservation. Community buy-in to the project, and the strong participation of women and local governments, have been critical for success. Lucy Amissah and Richard Kuutah Ninnoni (page 20) continue the themes of awareness-raising and community participation in fire management in their article on the situation in Ghana.

Finally, Carmenza Robledo (page 23) describes a new guide commissioned by ITTO for measuring and making use of the carbon benefits generated in forestry projects. This article is relevant to the general theme of IFM because uncontrolled fires can release the carbon stored in forests, thereby negating the climate-change mitigation effect of sustainable forest management.

The various guides and guidelines ITTO has developed over the years have had far-reaching effects. The ITTO Guidelines on Fire Management in Tropical Forests, referred to above and published in 1997, have provided a starting point for policies and programmes to address the socioeconomic and environmental problems related to fire in tropical natural and planted forests. This has been an important contribution, although, as Bambang Hero Saharjo points out, the far greater challenge lies in implementing them. As the articles in this edition show, substantial progress has been made in such implementation, but much more is needed.

Dr Goldammer warns (on page 3) that, as of mid-2015, an El Niño event is developing that could become “the strongest such event in the modern era”, with the potential to produce extreme fire weather in the tropics in the months ahead. The alarm bells may soon be ringing again, but it's clear that many countries are now better prepared to put a brake on wildfire.

¹ See the box on page 8 for more information on ITTO's work on fire management.

ITTO's proactive approach to fire management

The Global Fire Monitoring Center finds that ITTO has been at the forefront of the international response to the increasing occurrence of wildfire in tropical forests

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Grassroots: Local community members discuss the defence of village and agricultural assets against wildfire in Mozambique. Photo: GFMC

Since the 1980s, ITTO has supported its producer member countries in wildfire monitoring, assessments, post-fire rehabilitation measures, community involvement in integrated fire management, and policy development (notably through the ITTO Forest Guidelines on Fire Management Tropical Forests—ITTO 1997).

This article summarizes the history of ITTO's involvement in fire management in tropical forests. It presents my view as the director of the Global Fire Monitoring Center; I have been involved in fundamental fire ecology research in the tropics and in advising countries throughout the tropics in capacity building in fire management and in the development of fire management policies since the 1980s. In preparation for the 51st session of the International Tropical Timber Council (November 2015), I was requested to review fire problems and fire management solutions in countries supported by ITTO over the last quarter-century. Did the projects contribute to the achievement of ITTO's Objective 2000 and its policy work on forest fires? What lessons can be drawn to further improve ITTO's programme of work on forest fires?

Escalating fire use and wildfires in the 1980s

In 1982–1983, a severe drought affected the maritime continent of Southeast Asia, the result of an extreme El Niño–Southern Oscillation event (Box 1 outlines the threat posed by the current El Niño event). In northern and eastern Borneo, the drought started in July 1982 and lasted until April 1983, interrupted only by a short rainy period in December 1982. Monthly precipitation dropped below critical values along the coast and for up to 200 km inland. This created conditions favourable for slash-and burn and other land-clearing activities; many of the fires got out of control, however, and escaped as wildfires into highly fire-sensitive tropical forest ecosystems (note that some tropical forests are more sensitive to fire than others—Box 2). By the end of the drought, the area affected on the largest island in the

Box 1: Will a strong El Niño affect fires in the tropics in 2015?

El Niño, the warm phase of the El Niño–Southern Oscillation (ENSO), is associated with a band of warm ocean water that develops in the central and east-central equatorial Pacific (approximately between the International Date Line and 120° W). El Niño is accompanied by high air pressure in the western Pacific and low air pressure in the eastern Pacific. High air pressure over the “maritime continent”, which includes the archipelagos of Indonesia, Papua New Guinea and Malaysia, and the surrounding shallow seas, results in a decrease in precipitation and extended drought and consequently in an increase in the flammability of tropical ecosystems. Teleconnections of the ENSO may also result in droughts elsewhere, including in Africa, Central America and parts of North America. In 2015, El Niño is intensifying much earlier than usual. At the time of writing (July 2015), the sea-surface temperature anomalies in the near-equatorial Pacific Ocean had climbed to 1.5 °C above average, which is the threshold for a strong El Niño if persisting for a three-month timeframe. This El Niño is expected to continue intensifying into spring 2016 because most El Niños last 9–12 months. Later this year, the 2015 El Niño may become the strongest such event in the modern era. Countries traditionally affected by an El Niño-triggered drought should be prepared for extreme fire weather in the months ahead.

For more short-to-long-term fire-weather forecasts and models, see the Global Wildland Fire Early Warning System, a portal offered by the Global Fire Monitoring Center in cooperation with the Canadian Forest Service, at www.fire.uni-freiburg.de/gwfews/index.html.

region—Borneo—exceeded 5 million hectares. In East Kalimantan (an Indonesian province on Borneo), about 3.5 million hectares were affected, comprising 0.8 million hectares of primary rainforest, 1.4 million hectares of logged-over forest, 0.75 million hectares of secondary forest and 0.55 million hectares of peat-swamp biomes.

These fires were hardly noted internationally, but the size of the area burned prompted the Government of Indonesia to seek ITTO support in a damage assessment and to investigate options for the rehabilitation of drought- and fire-affected rainforests. A study titled “Investigation of



Safe preparation: A fire management team assists a local farmer to conduct a safe prescribed burn to prepare the land for a vegetable crop in Brazil's cerrado biome. Photo: Prevfogo/IBAMA

steps needed to rehabilitate the areas of East Kalimantan seriously affected by fire” included a complete inventory of the fire damage (with the results quoted above) and led to the establishment of a demonstration plot for the rehabilitation of fire-affected forests.

It soon became apparent that Indonesia's Ministry of Forestry had limited capacity to deal with the complex issues related to fire. The manifold interacting factors—such as the underlying reasons for fire use by small landholders, the impacts of the growing palm-oil industry, the consequences of the transmigration programme, and the role of climate variability—required a coordinated national approach to fire management if Indonesia was to cope with the problem in the long term. Part of the country's response was the development of the National Guidelines on the Protection of Tropical Forests Against Fire, a process that was also supported financially by ITTO and which aimed to build national capacity in fire management at all levels. The article by Bambang Hero Saharjo in this edition (p. 5) discusses the emergence of the issue of smoke pollution in Indonesia (and beyond) from the 1990s.

Indonesia and other Southeast Asian nations were not alone in having to grapple increasingly with fire problems, which accelerated throughout the tropics in the 1980s. Satellites showed, for the first time, the increased use of fire in the conversion of tropical forests to agricultural and grazing lands and in the establishment of large-scale forest, oil-palm and bioenergy plantations in the tropical rainforest zones of South America and Central America, prompting an international response.

In 1989, the Fire Ecology Research Group at Freiburg University in Germany convened the 3rd International Symposium on Fire Ecology, “Fire in the Tropical Biota”, the first global conference to address fire in the tropics using an interdisciplinary and cross-sectoral approach (Goldammer 1990). The conference heard alarming reports from the tropics and received scientific contributions, and the conference resolution, the “Freiburg Declaration on Tropical Fires”¹, resulted in the formation of new coalitions, projects and programmes in interdisciplinary research and development.

¹ Visit www.fire.uni-freiburg.de/latestnews/firebulletin.htm for the complete text of the Freiburg Declaration.

Box 2: The role of fire in tropical forest ecosystems

The impacts of fire and fire management options in tropical forests depend on the vulnerability, resilience and adaptation of the various types of forest ecosystem, broadly described below.

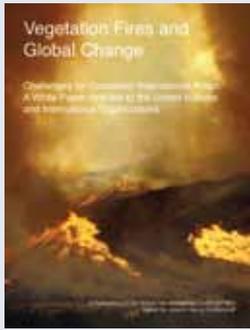
- **Natural equatorial evergreen (perhumid) tropical rainforest.** Tree species and other endemic vegetation (understorey) are highly sensitive to fire because even surface fires of low-to-moderate intensity kill the trees due to their thin bark, which does not protect the cambium from lethal temperatures. Regeneration after fire is limited due to the slow recolonization by seeds distributed by wind or animals. The endemic fauna is generally not adapted to fire. *Fire management:* complete fire exclusion.
- **Natural seasonally dry tropical forests.** In the regions adjoining equatorial evergreen rainforests, distinct rainy and dry seasons support the establishment of natural deciduous and semi-deciduous forests. These forests are highly flammable in the dry season; for millennia they have been subject to natural and—most importantly—human-caused fires. With thick protective bark, tree species in natural seasonally dry tropical forests may survive surface fires of low-to-moderate intensity occurring in the early dry season. Resprouting (coppicing) and an active seed bank allow regeneration in case of damage by high-intensity fires in the late dry season. Fire is often used by forest dwellers to favour the growth and harvest of non-timber forest products, such as fodder, fruits, honey and leaves. *Fire management:* the application of traditional early burning practices (setting fire during the early dry season) will stimulate the production of non-timber forest products and reduce the amount of combustible material (“surface fuels” such as leaves, shrubs and grass understorey) which, in the late dry season, could otherwise lead to high-intensity damaging fires.
- **Tropical industrial forest plantations.** Many species planted in industrial plantations, such as exotic *Pinus* and *Eucalyptus* species, evolved in natural fire ecosystems. The natural role of fire in the home ranges of these species should be considered in plantation establishment. *Fire management:* regular natural—and in case of industrial plantations—management-set prescribed fires will help reduce damaging wildfire in planted forests. Prescribed burning is used to reduce the thick layers of needles, leaves and other fallen woody materials and thereby also to stimulate natural regeneration.

Response since the 1990s

The 1990s saw an increased number of initiatives that addressed, among other things, fire science at the ecosystem level in the tropics; the social, economic and political dimensions of fire use and wildfires; and the implications of fire at the transboundary and even planetary scales, such as the role of vegetation fire emissions in global biogeochemical cycles, atmospheric functioning, and climate change.

The need for pragmatic action was obvious, and ITTO stepped in, initiating, soon after the Freiburg conference, the development of the ITTO Guidelines on Fire Management in Tropical Forests. ITTO entrusted the Fire Ecology Research Group at Freiburg University, which meanwhile had become a subdivision of the Max Planck Institute for

Box 3: White paper on vegetation fires and global change



Vegetation fires and global change: challenges for concerted international action, produced by the Global Fire Monitoring Center, is a white paper directed at the United Nations and international organizations. It is a global state-of-the-art analysis of the role of vegetation fires in the Earth system and is published as a collective achievement of the world's most renowned

scientists and research groups working in fire science, ecology, atmospheric chemistry, remote sensing and climate-change modelling. The aim of the white paper is to support the endeavour of the United Nations and international organizations, including ITTO, and their affiliated processes and networks, to address global vegetation fires. The paper provides the rationale for coordinated international action in crossboundary fire management at a global scale. Margareta Wahlström, Undersecretary-General and Special Representative of the United Nations Secretary-General for Disaster Risk Reduction, wrote the foreword, and she will also deliver the opening speech at the 6th International Wildland Fire Conference, to be held in the Republic of Korea on 12–16 October 2015.

Goldammer, J.G. (ed.). 2013. *Vegetation fires and global change: challenges for concerted international action*. A white paper directed to the United Nations and international organizations. Kessel Publishing House, Remagen-Oberwinter, 398 p. ISBN 978-3-941300-78-1. €5. To order go to: www.forestrybooks.com.



Box 4: The International Wildfire Preparedness Mechanism

The International Wildfire Preparedness Mechanism (IWPM) was developed as a follow-up to the UNECE/FAO Regional Forum on Crossboundary Fire Management, which was convened in Geneva, Switzerland, in November 2013. The IWPM, currently hosted by the Global Fire Monitoring Center, is a non-financial instrument serving as a broker and facilitator between national and international agencies, programmes and projects to exchange expertise and build capacities in wildland fire management and particularly in enhancing preparedness for large wildfire emergencies. The IWPM has been developed in tandem with the International Fire Aviation Guidelines and the International Manual of Common Rules for Fire Aviation. National agencies responsible for the management of vegetation fires as well as projects seeking or offering expertise are encouraged to visit the IWPM website at www.fire.uni-freiburg.de/iwpm/index.htm.

Conclusion

ITTO projects have established models to support the building of national-to-local fire management capabilities in several ITTO member countries in Africa, Asia and Latin America. National and international fire management guidelines have helped in developing concepts, policies and implementation strategies in fire management. The development of national fire management policies, associated with legal frameworks and implementation strategies, is now at the top of the agendas of many countries.

The exchange of experiences between neighbouring countries in “regional wildland fire networks” is receiving increasing attention. Among other things, these networks aim to increase capacity in both the public and private sectors by sharing expertise in fire management and the development of fire management policies. Three regional fire management resource centres—for Southeast Europe/Caucasus, Eastern Europe and Central Asia—have been established to facilitate the exchanges, and the utility of such models for tropical Latin America, Africa and Asia should be considered.

In the future, ITTO should continue building fire management capacities at the national-to-local level by supporting crossboundary and regional cooperation in fire management (Box 3). Bilateral and multilateral crossboundary cooperation in response to wildfire emergencies could also be enhanced through the International Wildfire Preparedness Mechanism, which constitutes an additional toolbox for creating efficient and safe interoperability in managing wildfire crises (Box 4).

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ITTO 1997. *ITTO guidelines on fire management in tropical forests*. ITTO Policy Development Series No. 6. Yokohama, Japan.

Chemistry and was transiting to the Global Fire Monitoring Center, and an Indonesian partner, to develop the basic materials for the guidelines. After a broad process of development, the final draft of the guidelines (ITTO 1997) was adopted at the 18th session of the International Tropical Timber Council.

With the guidelines in hand, ITTO encouraged countries to look at fire cross-sectorally and at a landscape level, funding ten projects on fire management in the period 1987–1999.² Ghana is one country that took action. In 1983 and 1987, West Africa was affected by extreme drought, and out-of-control land-use fires caused considerable damage to most forest reserves in Ghana and made affected forests more prone to subsequent fires. The article on page 20 of this edition describes two ITTO projects that helped Ghana develop a structured and efficient fire management system involving all relevant stakeholders.

ITTO was also requested to support capacity building at the community level in Latin America as a key approach to addressing fire on the ground and at the grassroots. Countries in the region (e.g. Brazil, Guatemala and Panama—see articles in this edition) recognized the importance of partnerships involving civil society and government agencies in fire management.

² ITTO has funded another nine projects on fire management since 1999 (and another 11 with fire-related components).

Indonesia's efforts to improve forest fire management

After 25 years of effort, many of the big challenges in reducing forest fire remain

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Health hazard: Smoke-haze pollution caused by land-use preparation, city of Palembang, South Sumatra, October 2014. Photo: Saharjo

The wildfires that affected Indonesia in 1982/1983 burned 3.7 million hectares, mostly in East Kalimantan Province (Lennertz and Panzer 1984). In their wake, the government attempted to find a way of preventing a repetition of the disaster, but without success, with fires affecting 66 000 hectares of forests in 1987, more than 500 000 hectares in 1991, and 5.11 million hectares in 25 provinces, including Maluku and Sulawesi, in 1994 (Goldammer 2001, 2006).

In 1995, President Soeharto launched a policy called “Land Preparation Without Fire” (“Pembukaan Lahan Tanpa Bakar”) in an effort to reduce the use of fire; under the policy, fire could no longer be used in preparing lands belonging to communities and corporations. It was hoped that this policy would eliminate the use of fire in land management and the initiation of wildfires, but it was not complemented by field or technical guidelines or by the provision of assistance to communities and corporations. Fire use increased, with subsequent wildfires.

The ITTO guidelines

As a follow-up to ITTO-sponsored activities in the rehabilitation of forests destroyed by fires in East Kalimantan, Indonesia, the International Tropical Timber Council embarked on the development of guidelines for the protection of tropical forests against fire. Pursuant to a decision of the Council, an expert panel comprising specialists from producer and consumer members was convened in Jakarta in 1995. Draft guidelines were formulated based on a background paper prepared by Dr Goldammer (Germany) and Professor Manan (Indonesia) and subsequently presented and published at the 18th session of the Council (ITTO 1997). The ITTO Guidelines on Fire Management in Tropical Forests were intended

to assist the management, conservation and sustainable development of tropical forests, and their publication was an important step in helping forest managers and national planners to overcome the problems they face in managing fire in tropical forests. Nevertheless, the greater challenge lies in incorporating the guidelines into national action plans and especially in implementing them.

Forest and land fires, 1997/1998

In the same year as the publication of the ITTO Guidelines (1997), Southeast Asia was severely affected by an El Niño–Southern Oscillation (ENSO) event. Satellite imagery showed that the first significant fires started in May 1997, reached a peak in September and declined to December; nevertheless, they continued until May 1998, especially in the Indonesian provinces of East Kalimantan, Aceh, Riau and Maluku, when they were extinguished by heavy rains. Fires started again in October 1998 in both Sumatra and Kalimantan, with negative impacts on neighbouring



Devastation: Burnt logs in a land preparation area, oil-palm plantation, Aceh. Photo: Saharjo

countries from the smoke generated by the fires. The cause of the 1997 wildfires was mostly land preparation, in which fire was used to convert native vegetation to forest plantations and estate crops; 65–80% of the forest area burned in East Kalimantan was in forest concessions and estate crops (WWF 1997). The Ministry of Forestry published a list of 176 companies that used fire to prepare their land for forest and estate crops, although none was punished.

ITTO support for building forest-fire management capacities in Indonesia

In 1993, ITTO and the Government of Indonesia negotiated a multi-phased project titled “Integrated forest fire management in Indonesia—Phase I: national guidelines on the protection of tropical forests against fire” [PD 12/93 Rev.3 (F)]. The national guidelines were developed in parallel with ITTO’s globally applicable guidelines and completed in March 1999 (Goldammer 1998; Jaya 1998). Indonesia’s National Guidelines on the Protection of Forest against Fire addressed the following topics

- National policy and regulations
- Forest-fire prevention strategy
- Mapping and evaluation
- Research and development
- Framework, organization and capacity building
- Social and economic performance
- Forest resources and utilization
- Training and community education.

When the guidelines were finalized, forest fire management trainers were provided with training with the aim of enabling them to teach others how to implement the guidelines (Saharjo and Goldammer 2011). The training was also intended to increase the capacity of local personnel in mitigating bush, estate and forest fires and in preventing fire incidents; provide local personnel with skills in the use of firefighting equipment; strengthen coordination in forest fire management involving forestry and non-forestry institutions at the local and provincial levels; and disseminate national guidelines and other government rules and regulations.

The curriculum for the basic training consisted of:

- Law, regulation and policy on forest fire management
- Basic knowledge fundamentals of forest fire behaviour and ecology
- Forest fire management
- Fuel management
- Fire detection
- Fire control equipment
- Fire control technique and strategy
- Mopping up.

By 1998, the total workforce trained in forest fire management was 15 825 persons—not nearly enough to protect the country’s forests, for which it was estimated that a further 40 600 skilled persons were needed.

The guidelines have been important in providing a clearer understanding of how to manage fire, but because of the many obstacles to their implementation in the vast reaches of a country still in a social, economic and political transition, the guidelines have had little impact on the ground (Saharjo and Goldammer 2011). This is partly a consequence of the first era of decentralization, which started in 2000 and provided the head of districts—the *Bupati*—with greater powers, including on law enforcement at the local level.

The Government of Indonesia, through the Ministry of Forestry, adopted the ITTO guidelines, but field implementation was weak, and the use of fire continued to be used for converting native vegetation to other land uses. Of particular concern were conversion burnings of peat-swamp forests in Kalimantan and Sumatra, which significantly contributed to biodiversity loss and carbon emissions and to severe regional smoke pollution, which, in turn, affected human health and security. The burning of peat-swamp forest is a problem that has still not been solved (Heil and Goldammer 2001; Page et al. 2013).

Looking back to the mid-1990s, the science community was well prepared to develop interdisciplinary approaches for analyzing the complex interactions between land use, fire and ecosystem processes (Goldammer 2006) and for investigating the role of emissions on regional and global biogeochemical cycles and short-to-long-term fire-related social issues. The political environment was not enabling for such research, however (Goldammer 2006); the door opened by the Government of Indonesia in 1991–92 when it invited the international donor community to assist the country in “fighting the fires”, especially aimed at reducing the regional smoke haze, soon closed again. Even though a number of internationally supported projects were initiated and implemented in the mid-1990s, the Government of Indonesia had limited interest in addressing such issues.

Indonesia’s commitment

The ASEAN Agreement on Transboundary Haze Pollution, a regional legally binding agreement aimed at reducing the occurrence and impacts of fire in the ASEAN member countries, was signed in 2002 and had been ratified by all ASEAN countries by 2014.

In 2010, the President of Indonesia declared the aim of reducing national greenhouse-gas emissions by 26% by 2020 through its own resources and by 41% if supported by foreign countries, with a reduction in vegetation fires one of the most important measures for reaching this ambitious goal.

Nevertheless, fires continue to burn. In 2014, an audit compliance team, lead by the author of this article, working with the Ministry of Environment and the Ministry of Forestry under the Presidential Task Force for Supervision

and Management of Development (UKP4), found that none of the 15 corporations operating in forest, forest-plantation and oil-palm concessions in Riau Province were observing the agreed rules of no-fire applications, as stated in signed government-granted licences. Fires returned again this year, blanketing Pelalawan city in January 2015 and spreading to various districts in Riau, reaching a peak in March 2015. Fires started again in June 2015 in Sumatra and Kalimantan, fuelled by precursor climatic conditions to the 2015 El Niño event.

With the ratification of the ASEAN Agreement on Transboundary Haze Pollution by Indonesia in 2014, the country enters a new phase of commitments. The efficient reduction of the use of fire in land use and land-use change will be a challenge. The fire science and management community of Indonesia is ready to contribute to the implementation of the agreement, drawing on almost two decades of cooperative efforts to develop a culture of fire prevention and preparedness and the international and national guidelines developed in partnership with ITTO.

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ITTO's work on forest fire

ITTO recognizes that fire is a serious threat to the forests of many tropical countries. One of its earliest responses was the publication, in 1997, of the ITTO Guidelines on Fire Management in Tropical Forests, which provide policymakers and practitioners with guidance on the development and implementation of forest fire management programmes. Around the same time, ITTO began funding projects aimed at improving fire management in various member countries; to date it has funded 30 projects across the tropics in which fire management is either the focus or a significant component. The ITTO Yokohama Action Plan 2002–2006 requested ITTO to “contribute appropriately to national and international efforts in the area of prevention and management of fire in relation to tropical timber-producing forests”. Recent ITTO biennial work programmes (2013–2014 and 2015–2016) have also supported work on forest fire.

In 2002 the International Tropical Timber Council decided to make the services of forest fire experts available to producer member countries experiencing forest fire problems, with the aim of assisting them to evaluate the country's forest fire prevention and management situation, identify strategies and actions and develop project proposals. Colombia, Guyana, Honduras, Nepal, Peru, the Philippines and Togo have all taken advantage of this facility.

ITTO is a member of the South Korea Conference Organizing Committee and the International Liaison Committee for the organization of the 6th International Wildland Fire Conference on 12–16 October 2015, at which ITTO will host a side-event on its field work on integrated fire management in the tropics. ITTO is also a member of the United Nations International Strategy for Disaster Reduction Global Wildland Advisory Group, the Global Wildland Fire Network and the Global Fire Monitoring Center. It has financed the participation of members of the regional networks in the tropics of Africa, America and Asia in a range of relevant meetings.

John Leigh, ITTO Projects Manager

Brazil's evolving approach to fire

Fire management is shifting from a “zero fire” policy towards integrated fire management

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Hazard reduction: Locals conduct a prescribed burn on indigenous lands at Xerente, Tocantins, Brazil. Photo: Prevfogo

Brazil has a land area of 8.51 million square kilometres, making it the largest country in South America and the fifth-largest worldwide. It is home to an extraordinary diversity of ecosystems, climate and topography, including the largest share of the Amazon (the world's largest contiguous rainforest) and other important ecosystems, such as the semiarid zone on the northeast coast (“caatinga”); the mountains, hills and rolling plains of the southwest; the midwestern savannas (“cerrado”); the world's largest wetland, the Pantanal; and coastal lowlands (Figure 1). More than 60% of Brazil's territory is forested, but deforestation, wildfires and systematic burning are important issues that must be tackled with national strategies.

Fire is an important source of greenhouse-gas (GHG) emissions in Brazil. According to the most recent official estimates (MCTI 2013), 55% of the country's GHG emissions between 2005 and 2010 were caused by land-use change, deforestation and agriculture. Fire is used as a tool in the conversion of native vegetation to agricultural lands and pastures, and also in slash-and-burn agriculture, the disposal of agricultural residues, and the maintenance of

grazing lands for livestock. The Brazilian government has made an international commitment to reduce the country's GHG emissions by 40% by 2020; achieving this target will involve, among other things, major improvements in fire management.

Brazil's environmental legislation provides a good legal framework for the protection of natural resources, pollution control and the recovery of areas degraded by human activities. The framework is based on the Brazilian Constitution of 1988, which states that everyone is entitled to an ecologically balanced environment, which is a public good for the people's use and is essential for a healthy life. Both government and society have a duty to defend and preserve the environment for present and future generations. Although Brazilian legislators have enacted laws and proposed strategies for fire management aimed at reducing wildfire damage, in practice these legal instruments are not being implemented effectively.

The large-scale land-use fires and wildfires that affected about 80% of the territory of Roraima state in 1998 attracted wide national and international attention and significant firefighting resources. The emergency response to those fires continued to influence fire management in Brazil, long after the emergency had passed. Fire prevention and suppression were at the core of the strategic approach, and little or no action was taken to address the root causes of wildfires.

The need for an integrated approach

An analysis of recorded wildfire causes in Brazil between 2005 and 2008 (Prevfogo 2009) showed that about one-third of wildfires were started by the use of fire in agriculture; about one-third were started by arson; about 6% were due to natural causes (lightning); and about one-quarter were due to other, often unknown causes. Wildfires

Figure 1: Brazil's biomes





Looking for clues: Participants in a Prevfogo training course learn how to investigate the causes and origins of wildfires. Photo: Prevfogo

are rarely restricted to a single sector, such as forestry or agriculture, or to a single landowner; they burn landscapes indiscriminately. Fire management, therefore, requires an integrated approach between government agencies, the private sector and civil society. Fire—both wildfire, and its use as a land-management tool—is an issue that affects everyone, potentially with global impacts, such as by contributing to climate change.

The need for an integrated approach to fire management and to tackle the root causes of wildfire and fire mismanagement is increasingly recognized in Brazil. The rest of this article describes some of the ways in which the National Center for the Prevention and Combat of Forest Fires (Prevfogo) is assisting a shift towards integrated fire management (IFM).

Prevfogo's role

Prevfogo is a federal institution charged with addressing wildfires. Its strategies for reducing wildfires take into account the recommendations of the ITTO Guidelines on Fire Management in Tropical Forests (ITTO 1997) and involve, among other things, fostering interinstitutional cooperation; the implementation of fire-use regulations; the dissemination of sustainable alternatives to the use of fire in rural land management; remote sensing monitoring; fire management; and environmental education and training.

Prevfogo acts in areas under federal jurisdiction where there is native vegetation and a high risk of fire occurrence; its particular focus is on indigenous lands, federal agrarian reform settlements, and Quilombola territories (Table 1), under the Programme of Federal Brigades for the Prevention and Combat of Wildfires. Brazil also has 75.5 million hectares

of protected areas in national conservation units; these units are managed by the Chico Mendes Institute for Biodiversity Conservation (ICMBio), which is also in charge of wildfire management in these areas. If required, Prevfogo can support ICMBio and state governments in their fire management programmes.

Training and environmental education

With the aim of building capacity among environmental technicians, fire brigades, farmers and the public, Prevfogo offers courses on: the prevention and combat of wildfires; controlled burning; alternatives to fire use in rural areas; the investigation of the causes and origins of wildfires; participatory methodologies; and environmental education. Prevfogo's environmental education programme examines the issue of wildfires and land-use burning in the context of climate change and addresses causes, consequences and solutions. It involves short courses, lectures, and programmes in schools and rural communities.

The training and environmental education programmes have begun a process of social change away from the previous "zero fire" policy in all situations. Given the fire ecology of savanna ecosystems such as the cerrado, which evolved under the long-term influence of natural and cultural fire regimes, a zero-fire policy is not only unrealistic, it is undesirable. Since 2005, increasing attention has been paid to the underlying causes of land-use fires and wildfires and the role of fire in ecosystem dynamics. Accordingly, more attention is also being paid to building the capacity of local communities, farmers, other landowners, and state institutions in the safe and ecologically sound application of fire, and to reducing unnecessary or detrimental burnings. Brazil is also engaged in an ongoing dialogue with other countries, ensuring the exchange of knowledge and experiences and the continued adaptation of strategic approaches.

Alternatives to fire in agriculture

A distinction is made in Brazil between "controlled" and "prescribed" burning. Controlled burning relates to the use of fire for economic/agricultural purposes, and prescribed burning relates to the role of fire in ecosystem dynamics.

Federal Decree 2.661/98 allows controlled burning in the management of rural properties. It cannot be denied, however, that controlled burning involves negative externalities, such as the gradual impoverishment of

Table 1: Prevfogo's priority areas

Area	No.	Area (ha)	No. of brigades	Priority areas (ha)
Indigenous lands	698	113 599 277	34	17 428 594
Agrarian reform settlements	9 156	88 102 902	27	3 067 398
Quilombola territories	154	1 007 827	01	237 000

Note: Quilombolas are groups who developed resistance practices in the maintenance and reproduction of their characteristic ways of life in a determined place. The origin of such groups is related to the process of resistance to slavery, which for 300 years subjugated blacks brought from Africa to Brazil (Associação Brasileira de Antropologia 1994).



Top class: Children at a rural school participate in a Prevfogo environmental programme featuring “Labareda”, Prevfogo’s mascot. Photo: Prevfogo

soils as a result of high temperatures and frequent fire use; increases in water consumption for household cleaning due to the soot produced by such burning (this happens commonly with sugarcane plantations, especially when they are located near the cities); decreasing rural production (due to soil impoverishment); and health problems among farmers. Moreover, the over-use of controlled burning has the potential to decrease water quality and water supply due to an increase in the concentration of certain substances in the water, increasing the need for water treatment. In the absence of such treatment or alternative water sources, water supplies are vulnerable to disruption (Smith et al. 2011).

Many sustainable, low-cost agricultural techniques are available that can substitute for the role played by fire in agricultural production, but many farmers lack access to this knowledge. A pilot project called “Amazon without fire” was conducted in 2000–2010 as a bilateral initiative of Italian Cooperation for Development and the Brazilian government. The project promoted the substitution of fire in rural areas with low-cost, sustainable techniques designed to also improve the quality of life of farming families. The results were so successful that the project has been exported to Bolivia under a trilateral agreement between Bolivia, Brazil and Italy, and a similar trilateral agreement is also under way in Ecuador. Prevfogo is implementing the approach in other projects and programmes aimed at decreasing the illegal and uncontrolled use of fire as a management tool.

The ecological role of fire

Moving more slowly, but also as part of a gradual paradigm shift, the zero-fire philosophy is being replaced by the idea that fire plays an ecological role in some ecosystems and can be useful in minimizing the damage caused by wildfire. Pilot prescribed-burning projects are now starting to happen.

A bilateral project between the Brazilian and German governments, called Prevention, Control and Monitoring of Fires in the Cerrado (the “Cerrado-Jalapão” project),

promoted IFM as a means of conserving the cerrado biome as a biodiversity hotspot and a globally significant carbon sink. The project was carried out on the indigenous lands of Xerente in Tocantínia, Tocantins state. A participatory approach was used to study indigenous traditional knowledge on fire use and to develop a prescribed-burning plan. The aim was to meet local land management objectives, promote flowering and fruiting, reduce fuel loads, establish vegetation mosaics, and minimize the incidence of high-intensity forest fires in the late dry season.

Brazil’s forest code

The new federal forest code, which came into force in 2012, reflects this change in approach from an unrealistic zero-fire policy to an IFM strategy—in accordance with Principle 4 of the ITTO Guidelines on Fire Management in Tropical Forests—that promotes the safe and environmentally sound use of fire in land and ecosystem management. The implementation of the new forest code, combined with increased knowledge, understanding and experience in IFM, has the potential to produce positive ecological effects while also allowing the redirection of institutional action and resources. Thus, Prevfogo plans to build a national empirical and science-based strategy that enables agencies to better use existing information on fire management and to create national expertise in IFM.

Prevfogo believes that IFM is the best strategy for dealing with the current and future challenges posed by wildfires. With its implementation, we expect great improvements in the effectiveness of fire agencies and in political and institutional approaches that integrate social, economic and ecological needs across administrative boundaries and landscapes.

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Awareness and vigilance reduce forest fire in Benin

A community-awareness campaign and other measures have reduced the area burned in Benin's state-owned forest plantations

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A burning issue: Villagers watch a prescribed burn carried out as part of community awareness-raising and training near the Lama Forest reserve. Photo: DGFRN, Benin

Setting fire to vegetation is a widespread sociocultural practice in Benin; local people use fire to clear fields, in hunting, and for other purposes. Most of Benin's territory is in an agro-ecological zone that is vulnerable to fire. Fires in the dry season (December to March), especially late in the season, are a major cause of forest degradation.

Benin's National Timber Department (Office National du Bois—ONAB) invests considerable human, financial and material resources in managing fire in its 22 917 hectares of state-owned planted forest, as well as in the Lama Forest Reserve, a natural-forest protected area located in the heart of the plantation estate. ONAB is implementing a strategy based on the ITTO Guidelines on Fire Management in Tropical Forests aimed at preventing and managing fires in the state forests with the involvement of communities.

Strategic approach to fire management

The strategy for managing fire in the plantations and the Lama Forest Reserve involves fire prevention based on surveillance with a view to promptly identifying fire outbreaks and their rapid extinguishment. The strategy is based on the following pillars:

- Awareness-raising in villages in the vicinity of forest areas on the damage that uncontrolled fires can cause to forests, biodiversity, vegetation cover and soil conservation and to local economies. Awareness is raised through local radio broadcasts and exchange meetings with target groups—as recommended in

principles 16 and 29 of the ITTO Guidelines on Fire Management in Tropical Forests.

- **Setting fires at the beginning of the dry season.** The Ministry in Charge of Forests undertakes early-fire-setting campaigns each year in which fires are set early in the dry season when the vegetation is not completely dry. These early fires decrease the fuel biomass in vulnerable areas, thus reducing the damage that would be caused if fires were set later in the season, when the fuel is dry.
- **Establishing firebreaks along the perimeter of plantations.**
- **Building human capacity through the recruitment and training of fire rangers,** another action recommended in the ITTO Guidelines on Fire Management in Tropical Forests (Principle 8).
- **Establishing an early-warning and fast-response system,** as suggested in Principle 5 in the ITTO guidelines. The system includes the operation of three 25-m-high watch towers at strategic locations. Each watch tower is equipped with a detection and locational system consisting of binoculars, a forest map and a compass. Two rangers staff each watch tower. When a column of smoke indicating a fire outbreak is spotted, the rangers geo-reference the fire and alert fire brigades by mobile phone. This system operates in the core area of the Lama Forest Reserve.

Table 1: Summary of fire management strategy outcome in ONAB's state plantations

Dry season	Managed forest area (ha)	Forest area burned (ha)	Percentage of total forest area burned (%)	Number of fire rangers employed	Average cost of fire management by ONAB (person-day equivalent)*
2011-12	19 668	2937	14.93	145	17 097
2012-13	20 680	1809	6.78	191	23 302
2013-14	22 917	809	3.53	226	28 980

*1 person-day = 1.260 CFA (≈ US\$2.52).

Outcome of fire management strategy

The implementation of the fire management strategy in the three dry seasons from 2011 to 2014 resulted in:

- a considerable reduction in the total area of natural and planted forest burned (Figure 1); and
- a reduction in the percentage of forest area burned (Figure 2).

Over the same period, the total area of planted forest increased as a result of reforestation activities. Table 1 summarizes the outcome of the fire management strategy.

The fire management strategy helps increase revenue for local communities by providing temporary jobs, with the number of fire rangers hired over three fire seasons varying between 145 and 226. On average, one fire ranger is employed per 115 hectares.

Future prospects for fire management

ONAB is developing an ITTO project proposal (PD 776/15 (F)) aimed at reinforcing its vegetation fire prevention and control system for the sustainable management of ONAB's plantations. Three outcomes are envisaged: 1) community authorities and target groups in local communities are involved in fire management; 2) an integrated fire management plan is developed; and 3) the technical and organizational capacity of grassroots stakeholders is increased.

Figure 1: Change in the area of forest burned, 2011-12 to 2013-14

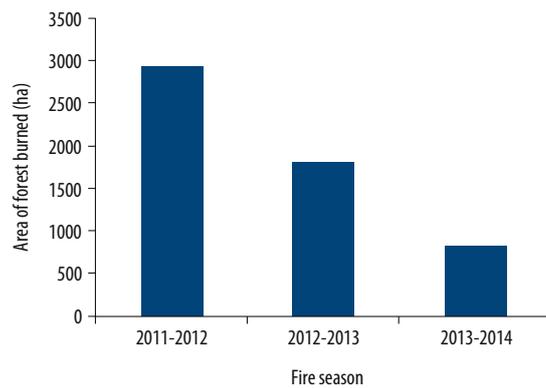
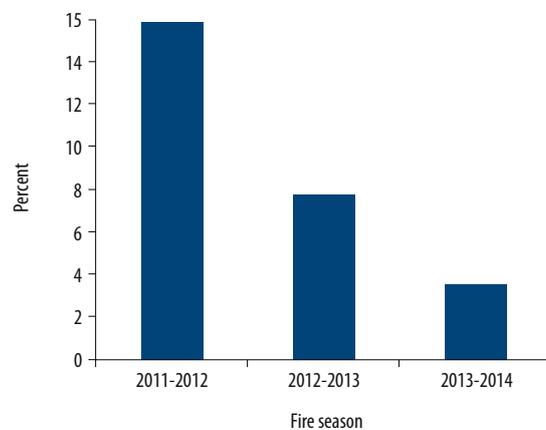


Figure 2: Percentage of total estate burned, 2011-12 to 2013-14



Engaging rural communities in fire management

An ITTO project has helped shift forest fire management in Guatemala from a top-down control model towards community-based integrated fire management

by **Carlos Roberto Gómez Quiroa**

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Fire management training: Community members of the San Jeronimo National Farm, and CONRED staff, are briefed on the black-line fire prevention method during a training workshop on integrated fire management. Photo: C. Gomez

Guatemala is a highly biodiverse country: it has ten physiographic regions, 14 life zones, 66 ecosystems and 4 million hectares of forest, with ecosystems that are variously adapted and sensitive to fires. Wildfire patterns have been changing in Guatemala as a result of social, cultural, demographic and economic changes and inadequate government policies. In particular, fire has become too frequent in fire-dependent ecosystems, and it has started to occur in fire-sensitive forest ecosystems where previously fire was exceedingly rare. To a lesser extent, fire has also been totally eliminated from some fire-dependent ecosystems, affecting the natural regeneration of trees and other plant species. The exclusion of fire from fire-dependent ecosystems has also led to the formation of deep layers of organic matter, which can become dangerous sources of fuel when favourable wildlife conditions are present.

Climate-change projections for Guatemala indicate higher temperatures, drier seasons and changes to the altitudinal thresholds of ecosystems.¹ Such changes could increase the risk of high-intensity forest fires, with direct impacts on the livelihoods of rural people and indirect impacts on forest environmental services that benefit urban areas.

Today, there is a sound knowledge base on the role of fire in different ecosystems. Fire-dependent ecosystems have evolved a relationship with fire in which species have developed adaptation strategies to survive, recover from and respond positively to fire. Fire-dependent ecosystems in Guatemala include pine forests, mixed pine–cypress forests, savannas and natural grasslands, among others. In fire-sensitive ecosystems, most plants and animals lack the attributes required to respond positively to fire or to recover rapidly after fire events. Such ecosystems are generally found in

areas of high humidity and rainfall, where fire is naturally inhibited. Nevertheless, some ecosystems that previously had difficulty in supporting fires (e.g. lowland moist tropical broadleaved forests, cloud forests and moist montane broadleaved forests) have been altered—mainly by human activities—to the point where they are now subject to frequent fire, resulting in further ecological change.

Integrated fire management

It is becoming increasingly evident that, for effective forest fire management, there is a need to move beyond the traditional strategy of fire control, firefighting and fire extinguishment towards integrated approaches that take a more holistic view of the role of fire. In Guatemala, integrated fire management (IFM) is based on an improved understanding of: ecosystem responses to fire (fire ecology); the socioeconomic factors that affect fire regimes; the potential role of fire as an ecosystem management tool according to technical, ecological and social requirements; the role of local communities as participants and decision-makers in community forest management and conservation; and the link between changes to the historical fire regime and the deterioration of local community livelihoods and local socioeconomic development. The IFM approach requires the full participation of local communities, with relevant institutions helping such communities to build capacity in managing and conserving their forest resources.

Overview of the project

ITTO project PD 590/10 Rev.1 (F): “Integrated fire management in rural communities of Guatemala: establishment of pilot sites for the implementation of sustainable integrated fire management practices” was financed by ITTO with support from the National Forest Institute (*Instituto Nacional de Bosques*—INAB), the

¹ That is, the altitudinal geographic locations of ecosystems will shift.

National Council for Protected Areas (*Consejo Nacional de Áreas Protegidas*—CONAP) and the National Coordinating Agency for Disaster Reduction (*Coordinadora Nacional para la Reducción de Desastres*—CONRED). The Better Living Association (*Asociación Vivamos Mejor*) implemented the project, with the participation of local civil-society organizations, community representatives and local technical staff in the aforementioned institutions.

The project sought to introduce IFM approaches and support local stakeholders involved in fire management at pilot sites in four regions with fire-dependent pine–cypress and pine forest ecosystems: the La Enea Regional Municipal Park in the municipality of Poptun, department of Peten, in northern Guatemala; the El Pinalon forests in the department of Chiquimula in the east; the San Jeronimo National Farm in the department of Baja Verapaz in central Guatemala; and the forests of the Quiscab river sub-basin in the departments of Solola and Totonicapan, to the west.

Training for institutions

The project made interventions at two levels. At one level, the project provided training on IFM and practices such as prescribed and controlled burning to governmental and non-governmental institutions at the national scale and to the personnel of those institutions in the project regions. The aim of the training was to help mainstream IFM practices into the policies and work schedules of the institutions responsible for forest management in Guatemala and to promote the involvement of their technical staff in project activities.

Developing capacity in communities

The second level of intervention focused on transferring capacities to rural communities in the four project regions by establishing IFM field schools. Training courses were held in community halls, schools, the backyards of houses of community members and in the forest; they provided real local examples, used flip-charts to provide illustrations, and employed participatory techniques and field trips for ecological interpretation. Community awareness and skills were strengthened on the following aspects:

- the role of local community organization in the management of forest ecosystems;
- the ecological roles of fire in local forest ecosystems;
- the causal links between the dynamics of fire-affected forests and the deterioration of local livelihoods and reduced potential for socioeconomic development;
- the possible impacts of climate change on forest fire;
- trends in the traditional use of fire by rural communities;
- participatory and inclusive planning strategies for IFM in community/municipal forests;
- the implementation of sustainable fire management practices, such as firebreaks and prescribed and controlled burns to reduce fuel loads and promote the natural regeneration of forest and ecologically important plant species (i.e. through ecological succession); and
- the monitoring and evaluation of local activities and the impacts of IFM.

Community experience-sharing sessions were held in the project regions with the aim of strengthening the capacity of community leaders. In these sessions, participants from the various regions were able to exchange information on, for example, the problems they encountered in fire management, the limiting factors they faced, and the local strategies they had

developed. Participants observed IFM outcomes in different environments and under different conditions, the types of local organizational and regulatory procedures employed, the importance and success of women's participation, and other project impacts.

Throughout the process, the project sought to generate successful community experiences in the implementation of IFM in forest ecosystems so as to develop a forest fire management model that could be replicated in other regions of the country. The approach was based on inclusive and participatory planning (communities, local governments and organizations, and state institutions) in the use of fire as a forest ecosystem management tool.

Project outcomes

Project activities were considered successful because of the high level of participation in project activities and the changes to existing fire regimes achieved at the pilot sites. These sites had previously been characterized by, among other things, a high frequency of forest fire, leading to the degradation of forest stands, limited regeneration and growth of forest tree species, stem deformation, increased bark thickness, an increased incidence of pests and diseases, and severe damage to undergrowth vegetation.

Project activities included the development of a protocol for monitoring IFM practices and impacts at pilot sites so that communities could see the results of their actions. Box 1 contains typical observations made by community members and local government officers on regeneration at project sites.

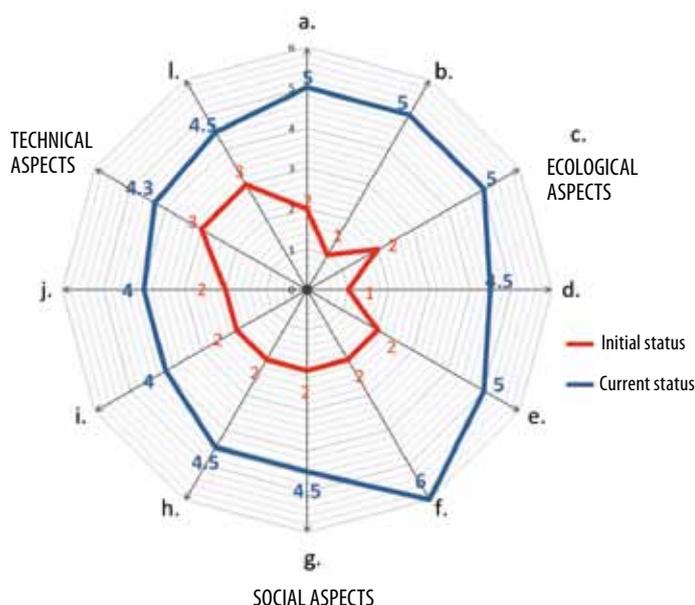
Figure 1 shows the social, ecological and institutional outcomes generated by the project based on an assessment carried out with the participation of community stakeholders and institutional staff. Among other things, the assessment found the following:

- **Social impacts.** There was a highly significant increase in the effective participation of community members in IFM planning. For example, according to Hector Saquil, administrator of the San Jerónimo national farm, Baja Verapaz, INAB, “with the help of the project, we managed to get people to participate in fire management activities”.
- **Ecological aspects.** The project achieved a change in fire regimes, which translated into an 80% reduction in the intensity and frequency of forest fires and the identification of areas for the implementation of controlled and prescribed burns. Ecological succession increased in the fire management demonstration plots, with a strong increase in the natural regeneration of both forest and non-forest species. Box 2 contains typical comments by community members showing the increased fire awareness generated by the project.
- **Institutional aspects.** There was an increase in the number of trained technical personnel and a change in mindset about forest fire based on the IFM approach. IFM has been mainstreamed into the policies of government institutions responsible for forest resources with a view to reducing the impact of forest fires and promoting IFM in Guatemala's tropical forest ecosystems.

Benefit–cost assessment

The project was subject to a benefit–cost assessment. Costs included expenditure on community organization workshops, local training, participatory planning processes, and the implementation and monitoring of IFM activities; benefits were mainly improvements in the value of both water and forest resources. Overall, the benefit–cost ratio was assessed at

Figure 1: Project impact assessment



No.	Meaning of numerical code
1	Very bad
2	Bad
3	Fair
4	Good
5	Very good
6	Ideal

See the description of the numerical value of each indicator in the annexed table

Figure code	Description of indicator
Ecological aspects	
a.	Annual number of fires in the project pilot sites that have an impact on forest fire
b.	Area affected by fire each year in the pilot sites
c.	Protection actions against forest fire (km of black lines)
d.	Level of knowledge of community groups about the role of fire in different ecosystems (concepts)
Social aspects	
e.	Percentage of community participants with a direct relationship with the management areas
f.	Total number of people participating in project activities
g.	Average participation in IFM training per group
h.	Level of planning and implementation of activities related to IFM
Institutional aspects	
i.	Number of local institutional technicians involved in IFM in the regions, by site
j.	Level of involvement of technical personnel in IFM at the pilot sites
k.	Level of skills of local institutional technicians in IFM
l.	Level of mainstreaming of IFM in government institutions responsible for natural resources

Box 1: Typical observations on forest regeneration in response to IFM approaches

“After 45 days, pine regeneration saplings started to come out in the areas where we had carried out controlled burns.” *Bacilio Osorio, Hacienda El Santo Community, Chiquimula*

“We saw that, as a result of the prescribed burns, saplings started to come out in the forest and we no longer need to reforest those areas.” *Rosario Pérez, community leader, San Juan Village, San Jeronimo Farm, Baja Verapaz*

“We have seen that in those areas where prescribed burns are carried out, the rate of pine regeneration is much higher than in areas where these burns are not carried out.” *Dennis Josue Pérez, CONRED, Regional Municipal Park of La Enea, Poptún, Petén*

Box 2: Typical comments on the project by community members

“Now we don’t have as many fires as we had before the implementation of the project.” *Adrián Carranza, Hacienda El Santo Community, Chiquimula*

“Now we can establish black lines² to protect our young trees from fires.” *Fernán Pérez Teodoro, president of the community association, Guardianes del Bosque de Chiquimula*

“We received training thanks to the Integrated Fire Management Project, and now we know that fire is a part of our forest and as such needs to be managed and not just eliminated.” *Arturo López, President of the Community Council of the Novillero Quiscab micro-basin, Department of Sololá*

² A “black line” is a line of controlled burns to protect against forest fire.

+14.74 in the San Jeronimo National Farm; +16.25 in the Quiscab forests; +2.20 in the Pinalón forests; and +2.18 in the Regional Municipal Park of La Enea. Thus, the project investment was assessed as cost-effective and advisable.

The project provided Guatemala with an opportunity to identify approaches leading to the adoption of IFM among the country’s rural communities. Such approaches include: the establishment of field schools; participatory planning, both in the implementation of activities and in local decision-making; monitoring; and benefit–cost assessment of IFM. The combination of these actions will stimulate the uptake of participatory approaches seeking to manage fire regimes in accordance with ecological, technical and social requirements while improving the ecological condition of forests so as to ensure the sustainability of the goods and environmental services they provide.

The project is in line with the ITTO Guidelines on Fire Management in Tropical Forests, which highlight the importance of strengthening and involving communities in the protection and management of forest fire and recognize that some forest activities carried out by local communities require the use of fire. The project could serve as a model to be replicated nationally to address the issues associated with forest fire.

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Community buy-in to fire management

An ITTO project is showing that educating young people is a key to improving forest-fire management in Panama

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Making a break: Community volunteers clear a firebreak in Panama's El Montuoso Forest Reserve. Photo: ANAM.

Panama has a land area of 75 417 km². It has nine provinces, five indigenous territories and a total population of 3.41 million people (2010 census), of whom 63% are urban. Three-quarters of the poor and 85% of the extremely poor live in rural areas; poverty is most severe among indigenous communities, with up to 95% of indigenous people classified as poor or extremely poor.

The pressure exerted by poor communities on natural resources affects soil productivity and watersheds, causes deforestation, has a negative effect on biodiversity and, ultimately, reduces the quality of life of local people. The main cause of deforestation is clearing for subsistence agriculture and cattle-raising, both of which use fire as a means of eliminating forest cover. Although regulated by the National Environmental Authority (*Autoridad Nacional del Ambiente*—ANAM), slash-and-burn agriculture remains a feature of every dry season in Panama. In view of this, ANAM is implementing ITTO project PD 441/07 Rev.2 (F): “Institutional strengthening of ANAM for integrated fire management in the tropical forests of Panama” with the aim of improving fire management in the country through community participation. Specifically, the project is developing techniques to help resolve problems associated with the devastation caused by forest fire, taking into account the cultural values of communities within a framework of natural resource protection, environmental conservation and national policy guidelines.

The project's pilot areas were selected using the following criteria:

- a high incidence of forest fire affecting unique ecosystems and increasing their vulnerability;
- a high incidence of deforestation and degradation in water catchment protection forests;

- private-sector interest in forest-fire prevention and control techniques in plantations;
- interest among local governments in integrated fire management and the conservation of natural resources; and
- a high level of community organization and interest.

On the basis of these criteria, the following three areas were selected:

- 1) Guacamaya Mount Hydrological Reserve (*Reserva Hídrica Cerro Guacamaya*), province of Coclé;
- 2) El Montuoso Forest Reserve (*Reserva Forestal El Montuoso*), province of Herrera; and
- 3) Buenos Aires Municipality (*Corregimiento Buenos Aires*), Ngäbe Buglé Comarca.¹

The work in the pilot areas is directed mainly at rural communities with the aim of reinforcing the importance of natural resources and stressing how forests, as a cornerstone of development, provide goods and environmental services for all. Awareness-raising activities were carried out with the aim of changing the attitudes of local people, especially the young, as well as of local authorities and education institutions.

The role of fire is now recognized in the pilot areas as an appropriate tool for good forest management; the objective is not to eliminate fire but to modify existing practices by applying prevention and control techniques to mitigate the negative effects of fire and to use it to support the conservation of natural resources. The project also includes activities for the rehabilitation of fire-affected areas so that, in the future, local communities can sustainably use the natural resources therein, thus improving their economies and living conditions.

¹ In Panama, a comarca is an autonomous territory.

Guacamaya Mount Hydrological Reserve

The Guacamaya Mount Hydrological Reserve was established through Municipal Resolution No. 10 of June 2000 and was elevated to the status of “protected area” in March 2012. The reserve covers 5117 hectares in the districts of Penonomé and La Pintada; it is part of a scenic landscape containing many tourist attractions and is one of the few sites in Panama that are both hydrological reserves and ecological reserves. The Guacamaya Mount Hydrological Reserve supplies drinking water to more than 12 000 people living in 42 communities in Coclé province.

In ten communities in the pilot area, the project established a cooperation and participation scheme with the aim of increasing local understanding of the problems arising from the inappropriate use of fire as a (cheap) tool of agriculture and cattle-raising. The greatest impacts of forest fire in the reserve are soil erosion and the total destruction of vegetation cover; these limit rainwater retention and water infiltration into the soil and groundwater, thus reducing community water supplies in dry periods.

The project has worked to change the behaviour of local people by providing training in basic forest-fire prevention and control techniques; reforestation activities in fire-affected areas; the construction of firebreaks in high-risk areas; the training of environmental volunteers, both at the community level and in schools located within the reserve; setting up a volunteer forest-fire brigade; and establishing an interinstitutional committee to coordinate these efforts and thus raise community awareness about fire management.

El Montuoso Forest Reserve

The Montuoso Forest Reserve was established through Act No. 12 of March 1977 over an area of 12 043 hectares in the district of Las Minas. It was established with the objective of maintaining the supply and quality of water from the La Villa, Mariato, Tebario and Suay rivers, the sources of which are within the reserve; these rivers supply drinking water to approximately 90 000 people in the provinces of Herrera and Los Santos.

Early in the project the people living in the reserve and in neighbouring areas indicated that they were willing to participate in project activities; they were aware of the importance of the reserve for the development of the province, given that it is considered to be a last refuge of biodiversity and the “lungs” of Herrera province. This positive attitude among the communities greatly facilitated project implementation; moreover, organized groups in the reserve already implementing activities for other ANAM projects could be relied on.

A particular feature of this pilot area is that its management plan does not allow the use of fire in agricultural activities, despite the complaints of local people who believe that fire is the cheapest tool available for soil preparation. In this pilot area, therefore, the project provided training to increase the

commitment of communities to respect existing laws so as to avoid forest fire. As a result of the ongoing close relationship that the project has established with the communities and education centres, an environmental volunteer programme has been set up in local schools and communities, and a volunteer forest-fire brigade has been established. These actions have encouraged local people to assume their responsibilities as residents of the reserve.

Buenos Aires Municipality

The Buenos Aires Municipality covers an area of 496 km² and has a population of 1499 people. In accordance with its ancestral culture, the Ngäbe Buglé Comarca is governed by its traditional authorities, made up of general, regional and local congresses, as well as the general, regional and local *caciques*, immediate chiefs and spokespersons. In this pilot area, therefore, the project adopted a different and rather unusual approach because it was necessary to obtain the approval of the comarca's General Congress.

With a full sense of respect for the idiosyncrasies of the indigenous population, the project provided training in basic forest-fire prevention and control techniques aimed at strengthening the community's cultural values in natural resource use and the responsible use of fire. The project helped establish a group of environmental volunteers in local schools and a volunteer forest-fire brigade. One of the greatest achievements of the project was that the work was carried out in full compliance with official rules and regulations governing the internal affairs of the comarca.

Project outcomes in pilot areas

In order to measure the project's impact, the problems to be addressed were identified from the point of view of the communities and all other stakeholders involved. To this end, baseline studies were carried out in each pilot area, generating information on climate, geology, geomorphology, hydrogeology, flora, fauna, hydrology and land use.

A SWOT [“strengths, weaknesses, opportunities and threats”] analysis workshop was held to identify the strengths and weaknesses in local communities and the opportunities and threats they face in relation to fire use. Among the threats identified at the workshop were deforestation, water resource degradation, impoverished soils and forest fire. With the identification of the problems, the project began to implement an environmental education programme focused on fire prevention with the aim of modifying the behavioural patterns and decision-making processes of community members.

The project has had a favourable impact in all three pilot areas: for example, it has raised awareness in participating communities on the integrated use of fire; produced changes in behaviour regarding the use of fire; and established student and volunteer environmental groups and volunteer forest-fire brigades. A total of 1489 adults and 354 children and other young people in communities have been trained under the project. The table summarizes the main project activities, and their extent.

Forest-fire brigades. These are teams trained in basic fire prevention, control and extinguishment techniques, first-aid procedures, controlled and prescribed burns, the rehabilitation of areas affected by burning practices, risk management procedures and climate-change awareness. The brigades are composed of personnel from ANAM, other relevant institutions and members of each community.

Environmental volunteers. These teams are designed to advise communities on how to conserve natural resources. They have been trained in topics related to environmental care and protection, and they are responsible for producing a multiplier effect using the knowledge gained.

Table 1: Main project activities

Activity	Indicator
Training community members in three pilot areas in forest-fire prevention techniques	480 people
Establishment of three forest-fire prevention and control brigades (one in each pilot area)	36 people
Training field-days on integrated fire management techniques for community members in the three pilot areas	493 people
Organization and implementation of courses for forest firefighters addressed to community members in pilot areas	480 people
Educational field-days on the appropriate use of fire for primary and secondary education students in pilot-area communities	200 students
Follow-up activities for students participating in the environmental groups representing their schools in the communities	154 students
Firebreak construction in the three pilot areas	14 km
Control of forest fires	12 fires
Rehabilitation of areas affected by forest fire	18 ha

School environmental groups. These are teams of school children and other young people who have been made aware of and trained in forest-fire prevention; climate change; soil, air and water pollution and its impacts; recycling; conflict resolution; risk management; and first aid. They will also act as multiplying agents in their communities by creating awareness among community members.

Community buy-in

Communities have generally been receptive to the project and the need to improve fire management and to participate in efforts to do so. A large part of the mountain range that runs through Panama has been deforested, and this has been associated with an increased scarcity of water and changes in the microclimate, making it much drier than in the past. This, in turn, has affected water supplies and agricultural production and made areas more prone to fire, particularly community plantations (both agriculture and trees) and the remaining secondary and degraded forests. Moreover, most local communities live on the fringes of forested areas, and forest fires have the potential to destroy their villages and towns. Last but not least, the communities have learned the hard way that they will have to fend for themselves, because the central government is able to provide few fire management facilities and infrastructure.

Lessons learned

The project has produced the following key lessons:

- Community buy-in to the project has facilitated the implementation of activities—people are committed to project outcomes and existing organizational structures are involved. This has created synergies among the various stakeholders that should help ensure the sustainability of project outcomes.
- To ensure the active participation of communities it is important to consult all members about existing organizational set-ups and individual and community interests.
- The participation of women is a key element in the implementation of project activities (especially given that the gender ratio in the local population is 60% women to 40% men). Women’s roles are changing; increasingly women not only manage households but are also involved in community activities developed through projects.
- The support of institutions active in the pilot areas, such as the National Civil Protection System (*Sistema Nacional de Protección Civil*), fire brigades, the Catholic Church, the Ministry of Education, the National Police, local authorities and ANAM, has made it possible to integrate the efforts of all these participants in project implementation.

- If communities can see that they will benefit directly from a project they are more likely to provide their labour inputs, while the project provides logistical support.
- The participation of local governments (e.g. mayors and town councillors) as key stakeholders has empowered them in all areas related to the environment and, in particular, in the use of fire. This, in turn, has facilitated the integration of these authorities with communities in the pilot areas.
- We have learned that it is not easy to change cultural patterns, traditions and customs on fire use in communities. Fire prevention activities and everything related to the care and protection of natural resources should go hand in hand with a holistic education process, which must begin at an early age so that children learn to respect, care for and protect the environment.

Project sustainability

Even after project completion, the highly motivated brigades of environmental volunteers and forest firefighters, in coordination with community members in each of the pilot areas, will continue to coordinate patrolling, surveillance and firebreak construction activities during dry seasons as forest-fire prevention measures. Teachers are committed to continuing the fire-education programme in schools, thereby ensuring that the school-based environmental groups continue to act as multipliers of information and knowledge and to raise awareness about the appropriate use of fire among young people, including in communities that have not yet been reached.

This project, carried out in Panama with ITTO financing, has been a very positive experience. It has ensured the participation of—and worked hand-in-hand with—local communities in decision-making and the coordination and implementation of all project activities. Such participation is essential if the ongoing and increasing threat posed by forest fire in Panama is to be managed effectively.

Forest fire management in Ghana

ITTO-funded projects have been important in developing an efficient fire management system, but more needs to be done

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Paying attention: Parade of community fire volunteers adjacent to an established green firebreak at the Bosumkese Forest Reserve, Bechem, Ghana. Photo: R.K. Ninnoni

At the end of the twentieth century, Ghana had a forest area of 8.2 million hectares (ha), but by 2010 this had decreased to 4.9 million hectares (Oduro et al. 2012). A suite of factors contributes to forest loss and degradation, but wildfire is regarded as the most important cause of forest degradation (Hawthorne 1994). Ground fires had been recorded in some forest reserves in Ghana before 1983, but they had caused little damage. However, an extended drought triggered by the El Niño-Southern Oscillation (ENSO) event in 1982/83 predisposed almost all forest reserves to wildfires, which caused considerable damage to forest and wildlife and made the affected forests more prone to subsequent fires.

The Government of Ghana promulgated the Control and Prevention of Bushfires Law in 1990, which sought to establish institutional structures across the country, including volunteer fire groups, and set fines and penalties for people starting bushfires. Contrary to expectations, however, the law had little impact because there was a general lack of data on which forest managers, local authorities and policymakers could base their actions. Additionally, there was little stakeholder collaboration in wildfire prevention and control, with many forest-fringe communities lacking sufficient training (and motivation) in fire prevention and suppression. To address these gaps, two ITTO-funded fire projects [PD 32/98 Rev.1 (F) and PD 284/04 Rev. 2 (F)] were implemented in Ghana to establish an efficient fire management system with the participation of all relevant stakeholders. The system developed through these projects has served as a blueprint for wildfire management interventions in Ghana.

Developing a fire management system

The first project, “Forest fire management in Ghana” [PD 32/98 Rev.1 (F)], was implemented from 1999 to 2003 with the specific objective of reducing the rate of natural forest depletion by developing efficient fire management systems. The CSIR-Forestry Research Institute of Ghana (CSIR-FORIG) implemented the project in collaboration with the then Planning Branch (now Resource Management Support Centre) of Ghana’s Forestry Commission and Ghana National Fire Service. The project also benefited from the expertise of staff in the United States Department of Agriculture Forest Service.

Identification of causes and effects of forest fires

The causes and effects of fire and its role in farming systems were identified and documented through a series of surveys of forest-fringe communities and other fire users. The study showed that fires in forest areas were mostly related to farming activities. It also found that using fire in land preparation had numerous benefits for farmers, and farming without fire was impractical. This led to a recommendation for the development of guidelines on fire use in farming systems, which was subsequently achieved through a successor project implemented by the Ghana Forestry Commission. A system of fire reporting was also institutionalized (and is now used by Forestry Commission staff) to monitor fire occurrence and evaluate the impact of fire management interventions. Tracking the dynamics of fire occurrence helps forest managers in planning and deploying resources to prevent and control fire.

Effective forest-fire control systems

In collaboration with community leaders, district assemblies and the Ghana National Fire Service, ITTO project PD 32/98 Rev.1 (F) recruited and trained 412 fire volunteers and equipped them with basic firefighting tools. These volunteers formed a network of patrol teams for early fire detection, alerts (through the use of motorized transport) and suppression. The project piloted the effectiveness of “green firebreaks” (40-metre-wide bands of evergreen species that are relatively fire tolerant, with the ability to branch laterally along the periphery of the forest) in suppressing undergrowth, thereby reducing fuel loads and slowing the spread of fires into forest reserves and other protected areas. The green firebreaks were assessed as effective in slowing the spread of fires into forest reserves, thus facilitating the natural regeneration of fire-degraded forests. The establishment of green firebreaks around forest reserves is now an integral part of the operations of the Forestry Commission’s Forest Services Division in rehabilitating fire-degraded forests. A manual of procedures for forest fire management was developed to assist district-level forest officers in protecting forest reserves.

Wildfire prevention education and awareness programmes

A number of fire prevention activities are carried out at the onset of each fire season in Ghana. Various stakeholders (i.e. the Forest Service Division, the Ghana National Fire Service, traditional authorities, district assemblies, fire volunteers and farmers) are brought together to launch the annual anti-bushfire campaign with the purposes of sensitizing fire users and putting them on alert in the event of wildfires. Education and awareness-raising on fire prevention was carried out before the project; it was done without a communication plan, however, and messages were not targeted at specific audiences. The project developed a fire prevention communication plan with messages for target audiences, and this has been used by successor projects in awareness-raising programmes.

Development of mechanisms for rehabilitating fire-degraded forests

Different plant species at different stages of growth have varying degrees of fire tolerance. Plants that can tolerate or survive fire have certain traits that afford them protection against it. In rehabilitating fire-degraded forests it is important to select the right tree species because survival through the seedling stage of the life cycle is critical for successful establishment. The following 13 Ghanaian forest tree species representing a wide range of ecological types were tested for their suitability for rehabilitation in fire degraded forests—*Antiaris toxicaria*, *Blighia unijugata*, *Celtis zenkeri*, *Cola gigantea*, *Malacantha alnifolia*, *Mansonia altissima*, *Milicia excelsa*, *Myrianthus arboreus*, *Nauclea*



A canopy of *Senna siamea*, part of a green firebreak adjacent to Worobong South Forest Reserve. Photo: L. Amisshah

diderrichii, *Nesogordonia papaverifera*, *Tetrapleura tetraptera*, *Trichilia prieuriana* and *Triplochiton scleroxylon*. Traits tested included relative dry weight growth (relative biomass gain), relative diameter growth, root length, root volume, root/shoot ratio, moisture content and leaf surface area per dry weight ratio. *Milicia excelsa* and *Antiaris toxicaria* showed consistent dominance in traits (e.g. relative biomass gain and large root volume) related to re-sprouting ability of tree species.

One of the factors militating against programmes for the rehabilitation of degraded forests has been a lack of funds, but the adoption of a collaborative approach involving communities considerably reduces the cost of planting and maintenance. The main strategy identified for forest rehabilitation was using the taungya system of plantation development; a modified version of this system is in use today.

Project to strengthen community participation

The second ITTO-funded project, “Fire management and post-fire restoration with local community collaboration” [PD 284/04 Rev.2 (F)] was undertaken by IUCN from 2005 to 2011, with FORIG as the implementing agency and the Forestry Commission as a collaborating agency. The project worked with local communities with the aim of halting forest loss due to uncontrolled fires and improving the effectiveness of community-based fire management in Ghana, building on existing structures and the programmes developed by the earlier project. Among other things, this project improved coordination among stakeholders and clarified the various roles and responsibilities associated with fire management. The Ministry of Lands and Natural Resources adopted guidelines and a manual for the implementation of community-based fire management in Ghana developed by the project. The capacity of stakeholders was increased through training on fire prevention, pre-suppression and suppression. To consolidate the achievements made in the earlier project, 87 fire volunteers were recruited, trained and equipped. The project supported the reforestation of 87 hectares of fire-degraded forest using the modified taungya system.

Project impacts

The occurrence of fire in forest reserves has declined in recent times. In the 2011–2012 fire season (October to March), for example, the number of fires recorded was 13% lower than in the 2010–2011 season. This may seem a relatively small decline, but it is having a positive impact on cocoa cultivation in the forest transition zone. Some cocoa farmers who migrated from this zone to the southwestern part of Ghana because of the large-scale destruction of cocoa farms by wildfires in the 1990s have now returned to rehabilitate old cocoa farms.

The ITTO-financed projects laid the ground work for the development of the National Wildfire Policy (2006) through a project funded by the Government of the Netherlands, which provides a framework for interventions to address wildfire in Ghana. The National Wildfire Policy is facilitating coordination among stakeholders and reducing the duplication of efforts because the policy document identifies the roles and responsibility of all relevant stakeholders, and dialogue and collaboration among stakeholders in the implementation of wildfire interventions has improved. Overall, awareness of the negative effects of wildfires has increased among forest management actors and especially among forest-fringe communities. An important achievement of the ITTO-funded projects is that they afforded Ghana the opportunity to translate research results into practice and policy development in finding solutions to an emerging problem. More broadly, the ITTO projects have helped train a new generation of fire management experts and practitioners at various levels.

Conclusions and way forward

The two ITTO projects have helped Ghana develop a more structured and efficient fire management system that involves all relevant stakeholders. Forest-fringe communities on the frontline of fire prevention and control have the willingness and some capacity to help bring fires under control. Nevertheless, the supply of basic tools for fire suppression remains inadequate and unsustainable. This shortage is demoralizing for the network of fire volunteers, whose activities are helping to reduce fire and ultimately to promote natural forest regeneration and biodiversity conservation. The projects focused on a few selected forest-fringe communities, and there is an urgent need to spread the knowledge and capacity to deal with wildfire issues to other communities. The provision of firefighting tools to frontline firefighting groups and the inclusion of additional forest-fringe communities will consolidate the gains made. Green firebreaks are important in reducing wildfire spread, but almost all forest reserves in the transition zone have only partial coverage of such firebreaks.

Training in fire use and non-fire methods in agricultural activities is also needed. To achieve this, fire-use guidelines developed by the Dutch-funded project mentioned above should be published and used as a manual for training farmers. To determine the costs and benefits of fire management interventions and to make a case to the central government for funding for fire management, forest managers and other practitioners need training on the accurate assessment of fire damage.

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Quantifying the carbon benefits of forestry activities

ITTO has published a new guide on how to measure and make use of the carbon benefits generated in forestry projects

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Needing benefits: Local beneficiaries in an ITTO project stand in a field of newly planted teak seedlings in Papua New Guinea. ITTO projects—and other practitioners—can use the *Technical guide on the quantification of carbon benefits in ITTO projects* to monitor the carbon benefits of their activities. Photo: H.O. Ma, ITTO

According to the latest report of the Intergovernmental Panel on Climate Change (IPCC; Smith et al. 2014), the “agriculture, forestry and other land uses” (AFOLU) sector produces 25% of annual greenhouse-gas (GHG) emissions globally. A major reduction in these emissions is needed if the climate-change mitigation objective agreed in the 2009 Copenhagen Accord of the United Nations Framework Convention on Climate Change (UNFCCC) is to be achieved.

A significant fraction of the AFOLU sector’s GHG emissions arise from tropical forests due to unsustainable land-use and forest management practices. Conversely, conservation and sustainable forest management can provide carbon benefits, thereby helping to mitigate climate change. Several mechanisms have been created with the aim of supporting forestry activities that generate carbon benefits. The uptake of such mechanisms has been slow, however, due partly to a lack of knowledge among forest managers on the mechanisms and their regulations and a lack of information on how to estimate and measure the carbon benefits of forestry activities over time.

To help fill the knowledge and information gap, ITTO published the *Technical guide on the quantification of carbon benefits in ITTO projects* in early 2015. Prepared by the author as part of ITTO’s REDDES [“Reducing Deforestation and Forest Degradation and Enhancing Environmental Services in Tropical Forests”] Thematic Programme, the guide considers and builds on existing methods (e.g. FAO 2011; Harris et al. 2012; IPCC 2003, 2006; Herold and Johns 2007; Pearson et al. 2012; Petrokofsky et al. 2012) with the aim of simplifying decisions on the use of climate-change mitigation mechanisms within the UNFCCC, other regulated carbon markets, and voluntary carbon markets. This article describes the various components of the manual.

Questions addressed in the Technical guide on the quantification of carbon benefits in ITTO projects

General:

- What are the carbon benefits of forestry activities?
- How can these benefits be measured?
- What existing frameworks are relevant to forestry activities?

Related to carbon benefits in specific interventions:

- Which climate-change mitigation framework best fits particular circumstances, and have national decisions changed the options?
 - Is REDD+ an option?
 - What about the Clean Development Mechanism market?
 - Should another regulated market be used?
 - Should voluntary markets be used?
- How do you select the methodology that best fits your circumstances?
- Which stakeholders should be included, and how?
- Who owns the carbon benefits?
- Are there specific considerations for monitoring the carbon benefits in sustainable forest management?
- How can the carbon benefits in ITTO projects be monitored and reported if the project is not participating in a mitigation framework?

Target audience, and objective

The guide targets forest managers at the forest management unit (FMU) level who want to: calculate the potential carbon benefits generated by their forests; determine which existing mechanism to use; and learn about the specific requirements and challenges of the various mechanisms and methodologies. The guide adds value to existing technical guidelines on carbon accounting for forestry by offering a comparison of existing mechanisms and methodologies. The guide is not an assessment of those mechanisms and their methods or procedures, but, rather, a tool to help

... Quantifying the carbon benefits of forestry activities

Table 1: Potential impacts of various forestry activities on carbon stocks

Forestry activity	Mitigation activity	Carbon benefit (according to decisions and ongoing discussions in the UNFCCC)	Relation to land-use change if no project takes place (i.e. relation to “baseline/reference”)
Conservation, sustainable forest management (improved forest management, avoided deforestation, reducing deforestation)	Maintain a forest area and long-term carbon density in areas under pressure	GHG emission reduction	Avoiding change from forest to non-forest Avoiding degradation
Afforestation or reforestation	Increase forest area and carbon stocks	Carbon sequestration/carbon enhancement	Non-forest to forest
Restoration	Increase site-level carbon density		Forest to forest
Agroforestry and silvopastoral systems	Increase landscape-scale carbon stocks		Non-forest to forest
Biofuel plantations (wood and non-wood products)	Increase input for biofuel production and substitution through harvested wood products, when biofuel production does not increase GHG forest emissions	Creating the potential for substitution	Non-forest to forest

understand the options available for given activities at the FMU level and to enable forest managers to select the best option for their circumstances. The box lists the questions the guide seeks to address.

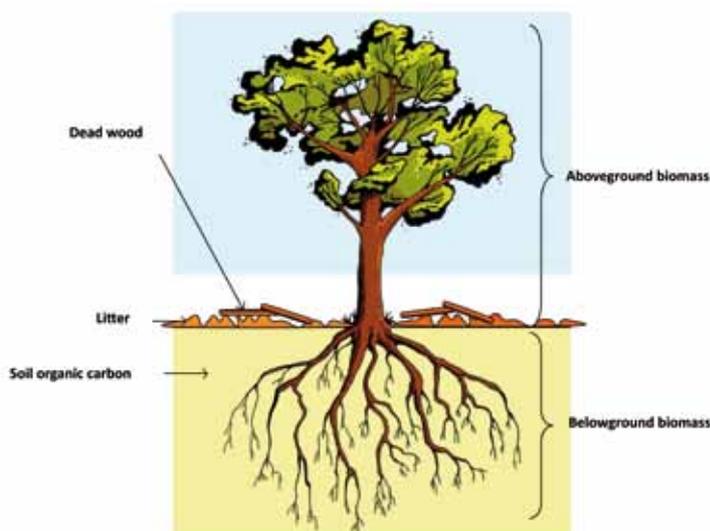
Carbon benefits from forestry activities

Forestry activities can generate carbon benefits in three main ways: 1) reducing GHG emissions; 2) sequestering carbon/promoting carbon enhancement; and 3) substituting carbon. Table 1 lists some of the many forestry activities that provide these benefits.

Carbon benefits arise when the carbon stock increases or is maintained. Forests have five carbon pools: aboveground biomass; belowground biomass; deadwood; litter; and soil organic matter (Figure 1). The harvesting of timber products reduces carbon stocks in the forest’s living biomass, and this loss is accounted for as a reduction in the potential *in situ* carbon benefit. If, however, the harvested wood is used in construction or for other non-destructive purposes, it may constitute a long-term carbon sink; thus, harvested wood products are recognized as another carbon pool (outside the forest). Wood and non-wood forest products can be used in the production of bioenergy; when this bioenergy is used as a substitute for fossil fuels, it can have a carbon benefit. Quantifying the carbon benefits arising from substitution involves calculating the difference in GHG emissions and sinks between the substitute and substituted materials.

Carbon benefits are estimated at the beginning or in the planning phase of an intervention (“ex-ante” estimation) and measured regularly during implementation. Two major challenges in estimating, measuring and monitoring carbon benefits are permanence and leakage. Permanence relates to the time that carbon remains in the biosphere—for example, a wildfire can release carbon into the atmosphere prematurely, reversing mitigation benefits; interventions should therefore promote an effect on the atmosphere that is as permanent as possible. Leakage concerns the potential for an intervention to cause GHG emissions beyond the boundaries of the intervention area; forest managers in charge of mitigation

Figure 1: Forest carbon pools



activities should therefore try to ensure that interventions in one area do not result in emissions in another (forested) area.

Possible mitigation frameworks

The guide differentiates between three mitigation frameworks: 1) the UNFCCC; 2) regulated markets; and 3) voluntary markets.

United Nations Framework Convention on Climate Change

The UNFCCC considers carbon benefits from forest ecosystems in three mechanisms: REDD+¹, A/R CDM, and NAMAs.

REDD+ refers to a negotiation item within the UNFCCC as well as to a series of ongoing processes, programmes and initiatives that are exploring climate-change mitigation options in the forest sector. Although there is no binding agreement (yet) on (or including) REDD+, the Conference of the Parties to the UNFCCC has agreed on a set of decisions regulating it. The guide explains these decisions.

A/R CDM refers to project activities on afforestation and reforestation (A/R) in the Clean Development Mechanism (CDM) of the Kyoto Protocol

¹ REDD+ = reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

and the possibility of establishing programmes of activities at the national level. The modalities and procedures of the A/R CDM were agreed in 2003, and several approved methodologies are available.

Nationally appropriate mitigation actions (NAMAs) are voluntary: countries are free to include forestry activities in their NAMAs in accordance with the decisions of, and guidance provided by, the UNFCCC.

Forest carbon markets and voluntary standards

The guide discusses two regulated markets (both based in the United States) that may be of interest to ITTO producer countries: the California Climate Action Registry (CCAR) and the Climate Action Reserves (CAR). The guide also presents standards for participation in voluntary markets, which, for any given voluntary standard, comprise the sum of “over the counter” transactions. The various standards are self-regulated but open to international scrutiny; they include Plan Vivo; Climate, Community and Biodiversity Standards (CCBS); Verified Carbon Standards (VCS); the Gold Standards; the American Carbon Registry (ACR); and REDD+ Social and Environmental Standards (REDD+-SES).

Considerations at the forest management unit level

The guide proposes a step-wise approach to considering carbon benefits at the FMU level (Figure 2). At each of the first six steps, the guide addresses three questions:

- 1) Why is this step necessary?
- 2) How is this step undertaken?
- 3) What happens if there is a significant change in circumstances and over time?

Step 1: Define boundaries

Forest managers need to consider both geographical and temporal boundaries. Geographical boundaries relate to the question of where an activity will take place, and temporal boundaries respond to the question of when it occurs. Changes in the boundaries over time will affect ex-ante estimation and monitoring requirements and need to be documented.

Step 2: Identify the institutional framework

In the guide, the “institutional framework” comprises the rules and regulations applying to different social actors that are relevant to the current and future management of a given area of forestland. Social actors include forest users as well as regulatory bodies and investors. Interactions between social actors and institutions can have a great influence on how forestland is used, and the guide explains how to characterize the social actors and the institutional arrangements relevant to an intervention.

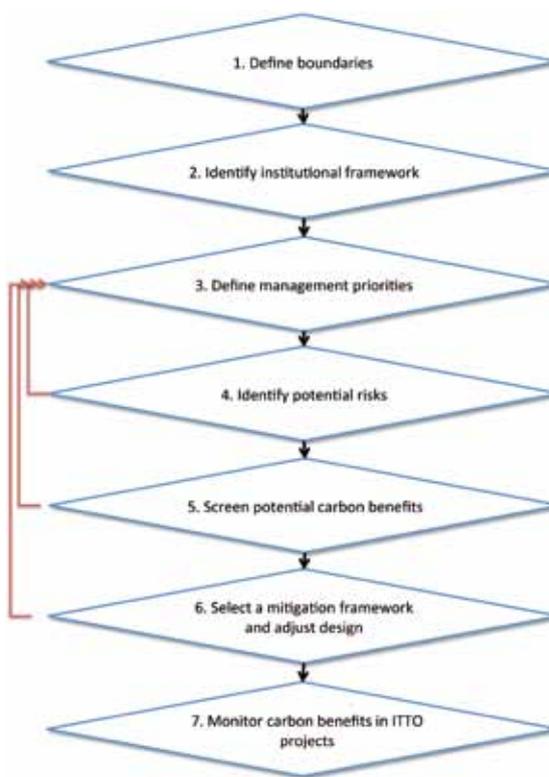
Step 3: Define the management priorities

Management priorities form the basis of forest management plans. If the highest priority is to maximize carbon benefits, planting/harvesting activities should be geared to ensure this, but this may affect other management priorities. Achieving an appropriate balance in management priorities is critical.

Step 4: Identify potential risks

The process of identifying risks provides information on the feasibility of management practices over time. If a project is liable for the carbon benefits in an FMU, it is responsible for keeping those benefits secure. Risks can affect the permanence of carbon benefits and need to be managed. The guide distinguishes between the following potential risks: political and regulatory; social; economic and financial; and natural disturbances and hazards.

Figure 2: Step-wise approach, from activity design to the monitoring of carbon benefits



Note: red lines show possible feedbacks.

Step 5: Screen potential carbon benefits

The aim of screening is to obtain preliminary estimates of the potential carbon benefits of a forestry project or activity in a cost-efficient manner. Thus, screening should be doable with information contained in the forest management plan and using existing (default) values for estimating carbon benefits. The guide explains the three recommended steps in screening potential carbon benefits: 1) select the most important carbon pools; 2) define the strata; and 3) select the most appropriate screening tool.

Step 6: Select the mitigation framework and adjust design

The mitigation framework defines which activities are eligible, the carbon accounting regulations and monitoring requirements, and the available carbon markets or payment schemes. To realize the carbon potential of an intervention it is important, therefore, to select the most appropriate framework. To facilitate the selection process and the quantification of carbon benefits, the guide presents the main frameworks and explains the regulations and methods governing each, and it provides a decision process for selecting the most appropriate framework.

Step 7: Monitoring carbon benefits in ITTO projects

This step explains how ITTO project managers can undertake the monitoring of carbon benefits derived in their projects when no other mitigation framework has been used, and it

Table 2: The main challenges in monitoring carbon benefits in SFM

Challenges in monitoring the carbon benefits of SFM	Strategies currently used	Remaining challenges
Clarifying forest status (e.g. the stage of degradation), which is necessary for defining boundaries and strata	Remote sensing—a good option for differentiating forest from non-forest but less useful for determining the stage of degradation	Estimating the stage of degradation, which is necessary for accurate stratification
Getting appropriate aboveground biomass equations or quantification for different sites; estimating the degradation stage	Use radar and optical remote sensing technology	Radar remote sensing can acquire data irrespective of haze and the persistently cloudy conditions in the humid tropics, but the signal of all available radar sensors tends to saturate at a lower value than the actual aboveground biomass volumes of tropical rainforests and increasingly there are errors in mountain areas
	Use light detection and ranging (LiDAR) sensors to overcome sensor saturation	Large-scale applications are not feasible due to narrow swath and high costs
Estimating aboveground biomass growth after harvesting (under differing regimes)	Ongoing research projects are aimed at developing the necessary models and testing aboveground biomass estimation techniques, combined with field inventories	
Quantifying carbon benefits in carbon pools other than aboveground biomass	Field inventories and ongoing research	Reducing the cost of field inventories for non-aboveground biomass pools (in remote areas)

clarifies who is responsible for it. Nevertheless, forest managers should always check if there are specific norms regulating the monitoring of carbon benefits in their countries. It is especially important that measurements are consistent with ongoing developments in national forest monitoring systems.

The guide provides information on establishing the land/activity area; emission factors; how to deal with uncertainties; how to establish and quantify leakage; and how to involve stakeholders in monitoring activities. It also provides a format for the voluntary monitoring and reporting of the carbon benefits of ITTO projects.

Opportunities and challenges in monitoring the carbon benefits of SFM

Although the capacity of SFM to generate carbon benefits has been recognized for some time, it is only starting to be included as an activity in mitigation frameworks. Table 2 outlines some of the challenges involved in monitoring the carbon benefits arising from SFM.

Who owns the benefits?

In promoting carbon benefits in an FMU, it is important to clarify who owns those benefits. This is a requirement for the sale of carbon certificates, and it is increasingly important in REDD+ negotiations, too. The clarification of the ownership of carbon benefits should be in line with land-tenure and land-use regulations and customary rights and claims.

Other guidelines

To promote consistency among intergovernmental organizations and avoid the duplication of work by forest managers, the guide refers to other guidelines for accounting for carbon benefits developed by intergovernmental organizations other than ITTO. They include guidelines

prepared by the IPCC, the Global Environment Facility, the United Nations Development Programme, the United Nations Environment Programme, and the Food and Agriculture Organization of the United Nations.

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The international trade of tropical timber is due for a period of relative stability

Sometimes it is worth reminding ourselves that, despite the success of many tropical-timber-producing countries in developing an international trade in added-value products, very little has changed in the past half-century or more in the market for natural tropical hardwood products.

A close look at the main tropical exporters of added-value products—Brazil, Indonesia, Malaysia, Thailand and Viet Nam—will show that the trade of such products depends largely on plantation resources such as rubberwood, acacia, albizia and pine. The main traded products from natural tropical forests are still logs, sawnwood and plywood.

Sure, the trade in wooden furniture and the like is worth far more than the trade in primary products; nevertheless, logs, sawnwood and plywood remain the backbone of the international trade in tropical hardwoods. This trade has experienced considerable uncertainty in recent years, but an upturn in the economic cycle could mean relatively calm times ahead.

Log import trends

China and India are the major tropical log importers; combined, they imported around 3.5 million m³ in the first quarter of 2015, down from almost 4.8 million m³ in the corresponding period in 2014.

Weakening demand for logs in China was partly responsible for the overall drop in log imports (China's first-quarter tropical log imports fell by 22%). Moreover, the log export ban by Myanmar eliminated a sizeable volume of logs from international trade, and the impact of this ban was felt in China and particularly India.

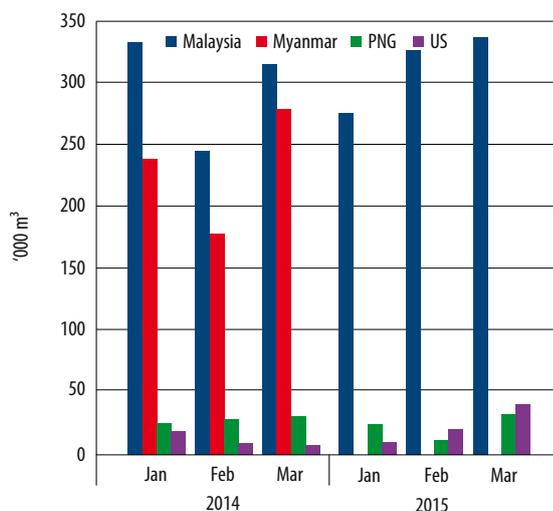
Indian importers accumulated vast quantities of teak and other hardwoods from Myanmar in the first quarter of 2014 in advance of the log export ban. Natural forest teak and gurjan from Myanmar have been the cornerstones of the timber industry in India, with teak used for interior end-uses and gurjan for plywood face veneers. Figure 1 clearly shows the impact on Indian imports of the log export ban in Myanmar.

Indian plywood manufacturers have struggled to find an alternative to gurjan, which Indian end-users prefer over pale veneers, mainly because of its red colour. Nevertheless, poplar-faced plywood is gaining acceptance, with the added benefit that it is cheaper than panels made previously with gurjan.

An alternative solution adopted by some major India plywood companies has been to invest in veneer production in Myanmar and to ship the veneers to India to be laid up into plywood.

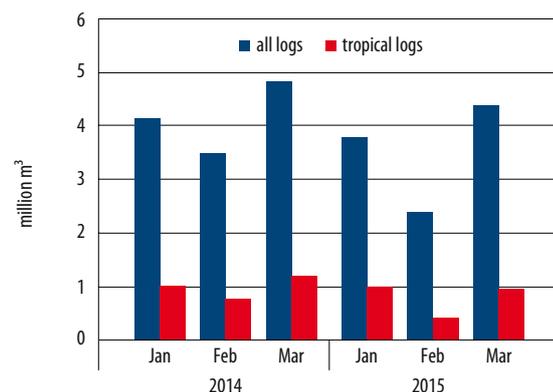
Japan is a significant tropical log importer, but its importance in the trade is declining rapidly. The country imported more than 500 000 m³ of tropical logs in 2010, but the volume declined to 300 000 m³ in 2013 and to 250 000 m³ in 2014.

Figure 1: Indian hardwood log imports, first quarter 2014 and 2015



Source: Zuba.com

Figure 2: China log imports, first quarter 2014 and 2015



Source: Chinese Academy of Forestry.

There was a 27% increase in tropical log imports in the first quarter of 2015 compared with the same period in 2014, but care is needed in interpreting this—the 2014 numbers were exceptionally low as importers braced for the negative effect on construction and house building of an increase in the domestic consumption tax.

Sawnwood import trends

US and Canadian sawnwood markets head in different directions

The differing trends for tropical hardwood sawnwood imports in the US and Canada in the first quarter of 2015 reflects the differing directions of the two economies. United States' imports increased by around 25% in the quarter, and Canadian imports fell by the same amount.

Almost all major suppliers have shipped significantly more to the US this year (to date) than they did in the corresponding period in 2014. The largest increases were from Cameroon (+108%) and Peru (+78%).

Brazil's shipments of sawnwood to the US grew by 20% month-on-month in March. Ipê sawnwood imports were almost unchanged, but imports of sawn virola and other species increased substantially.

Canadian imports of sapelli and balsa grow, despite overall decline

Canada's overall imports of tropical hardwood sawnwood declined by 24% in the first quarter of 2015 compared with the same period in 2014 (although the volume of sapelli imports increased by 46%, mainly from the Congo). The decline reflects the slowing of Canada's economy.

Growth in EU tropical hardwood sawnwood imports

European Union (EU) hardwood sawnwood imports from the region's three most important supplier countries increased sharply in the first quarter of 2015—by 10% from Cameroon, 18% from Malaysia and 31% from Brazil. There were also significant increases in imports from Côte d'Ivoire (+11%),

the Congo (+4%) and the Democratic Republic of the Congo (+25%). Imports also increased from Guyana and Suriname, which have not featured strongly in EU supplies in recent years. Imports were down by 14% from Gabon and by 31% from Ghana, however.

China's hardwood sawnwood imports rising

China has not been a major importer of hardwood sawnwood, but this is changing; imports of this product rose by 14% in 2014, to 8.01 million m³. About 85% of the country's hardwood sawnwood imports came from ten suppliers in 2014, with Thailand (mainly rubberwood) and the United States contributing 52% of the total. China's hardwood sawnwood imports declined by 32% in the first quarter of 2015 compared with the same period in 2014, however, mainly in response to China's slowing economy and weakening domestic housing market. The decline in tropical sawnwood imports was less severe, at 6%.

Plywood import trends

China leads hardwood plywood shipments to US

US imports of hardwood plywood grew by more than 40% in the first quarter of 2015 compared with the same period in 2014, with more than half coming from China. Hardwood plywood imports from China were higher in March 2015, at 178 000 m³, than at any time in 2014, and they were up by 28% in the first quarter of 2015 compared with the same period in 2014.

US hardwood plywood imports from Indonesia and Malaysia also increased in the first quarter of 2015, but at a slower pace than those from China. In contrast, first-quarter hardwood plywood imports were down, year-on-year, from Canada, Ecuador and the Russian Federation.

EU imports of tropical hardwood plywood increase

The EU imported about 105 000 m³ of tropical hardwood plywood in the first quarter of 2015, up by 19% over the same period in 2014. Imports from Malaysia, the largest supplier, were up by 33%, while imports from Indonesia were up by 21% and from China by 9%. After several years of decline, imports from Brazil increased by 19% during the period.

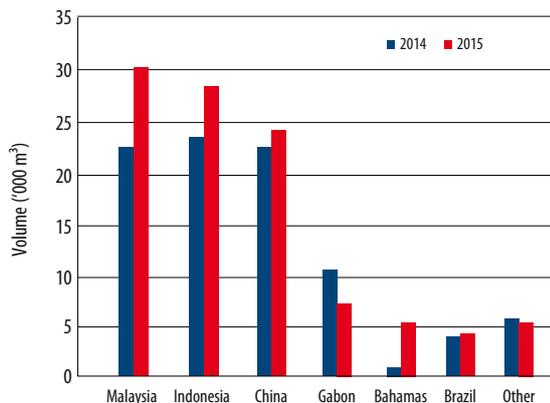
More than 80% of all EU imports of tropical hardwood plywood in the first quarter of 2015 was destined for the following four member states, in descending order: the United Kingdom, Belgium, the Netherlands and France.

The sharp year-on-year rise in EU plywood imports from Malaysia in the first quarter of 2015 is partly explained by particularly low levels of trade in the same period in 2014. Malaysia lost Generalized System of Preferences preferential tariff status on 1 January 2014, which contributed to a spike in EU imports from Malaysia in the closing months of 2013, followed by a slowdown in early 2014.

EU imports of Indonesian plywood benefited during the first quarter of 2015 from a stronger construction sector, particularly in the United Kingdom and the Netherlands, more regular break-bulk shipments, and positive perceptions of Indonesian efforts to stamp out trade in illegally sourced timber.

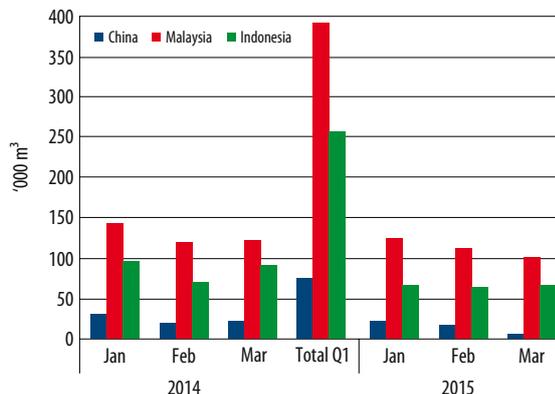
Imports of okoume plywood for the EU construction industry were lively in the first quarter of 2015, particularly for interior remodelling and especially in the Netherlands. The consumption of okoume plywood is rising slowing in the boat industry. The French market, while subdued, has regained some ground so far in 2015.

Figure 3: EU tropical plywood imports, first quarter 2014 and 2015



Source: ITTO/IMM analysis of EUROSTAT.

Figure 4: Japan's plywood imports from Malaysia, Indonesia and China, first quarter 2014 and 2015



Source: Ministry of Finance, Japan.

Improved demand combined with limited supply, especially for certified wood, has allowed okoume plywood manufacturers to push through minor price increases this year. Delivery lead times are becoming longer.

Double wammy for Japan

Japan's plywood imports fell by 15.5% in the first quarter of 2015 compared with the corresponding period in 2014, with imports from China dropping a massive 35%. Imports from the top suppliers, Malaysia and Indonesia, fell by 11.5% and 22.5%, respectively.

Demand for both domestic and imported plywood remains sluggish in Japan. Prices in the domestic market fell early in 2015 until one of the major domestic manufacturers announced a price increase, which took hold even though there was no change in the demand structure.

Because of the weak demand, plywood inventories grew in the first few months of the year but have now corrected. Plywood manufacturers in Sarawak, which supply large volumes of plywood to Japan, are facing log shortages, which is driving down production. This would normally mean price gains but, with the Japanese market so subdued, the gap between the price expectations of suppliers and importers is growing wider. Add to this mix the impact of the rapid depreciation of the yen, and the hurdles to stable trade become clear.

Looking ahead at demand drivers

Key EU tropical timber markets are bouncing back

There was significant growth in the euro value of tropical timber imports in nearly all the main EU markets in the first quarter of 2015. A particularly encouraging sign is that imports to the traditional tropical timber markets in Belgium, France and the Netherlands also increased sharply.

US housing market normalizing after seven years of turmoil

The housing market in the US is a major driver of wood product consumption, and prospects are improving. More Americans are looking for mortgages to buy homes, but the pace of loan applications has begun to slow, a sign that the economy and housing markets are normalizing.

The Federal Home Loan Mortgage Corporation, known as Freddie Mac, has forecast that housing starts will increase by 14% in 2015 and by more than 20% in 2016.

Japan private-sector demand projections

The Japan Lumber Importers Association has projected that wood-product imports will fall by almost 4% in 2015; housing starts will be lower than in 2014, and a weak yen will affect the profitability of importers. The general view is that demand for building materials will decline, affecting sawnwood and plywood imports, but demand for logs (mainly softwoods) is expected to hold up.

Greater timber self-sufficiency in China

China surpassed the US as the largest global trading partner in 2013; it is the main trading partner for more than 40 countries. With so many economies depending on trade with China, the projected continual slowing of growth in its economy will have a significant impact.

China's appetite for raw materials, including wood products, is showing signs of slowing, and recent announcements on investments in strategic timber reserves to increase self-reliance needs close attention. China's State

Forestry Administration has reported that it will establish an additional 14 million hectares of strategic national forests by 2020. These forests will comprise fast-growing tree species such as poplar and eucalypt, as well as high-value species.

In the long term, the plan to expand the planted forest estate may lead to a drop in the country's dependence on imports. In the short term, however, a decision to withdraw the right to approve felling from local administrations in northeast China and the Inner Mongolia Autonomous Region may result in a log shortfall that would boost the need for imports.

Strong growth forecast for India

India has emerged as a major timber importer. According to the Organization for Economic Co-operation and Development (OECD), the Indian economy will deliver growth of 7.3% in 2015, which augurs well for tropical timber suppliers. The OECD report notes that increased investment in infrastructure and some proposed structural reforms will improve the ease of doing business and encourage private-sector expansion.

India has a rapidly increasing urban population, and the current housing shortage of 62 million units is holding back development. The central and state governments are adopting measures to remove obstacles to investment in housing.¹ "Slum-free India by 2022"—the centre piece of the government's housing plan—will deliver incentives to companies building affordable homes through slum renovations. Such government plans for the housing sector will have an impact on demand for wood products, including tropical wood products.

The corner has been turned

The negative effects of the global financial crisis seem to be fading, and traders are looking forward to a period of calm before the next market downturn. Demand in the major Asian consumer markets will be sustained as India looks to import more and as China's government continues with its policy of transforming the economy to one based on domestic consumption rather than export-led manufacturing.

The signals from the EU are mixed, but it is encouraging to see some of the main tropical timber-consuming member countries beginning to import more tropical hardwoods. This momentum would be boosted if the EU can conclude voluntary partnership agreements with countries with which it is now negotiating.

¹ "Housing—the game changer", a Cushman & Wakefield research report, analyzed the impact that the housing sector had on various aspects of the Indian economy. See: credai.org/sites/default/files/reports/Housing-The-Game-Changer-Report.pdf.

Tropical and topical

Fires rip through Indonesia's Tesso Nilo National Park

A large number of forest fires are raging in Indonesia's Tesso Nilo National Park, once considered one of the world's biologically richest forests. According to analysis by the World Resources Institute based on satellite imagery from NASA, up to 185 fires have started in the park since late May 2015, most likely associated with land-clearing operations for oil-palm plantations and other development. Although Tesso Nilo is a protected area and home to endangered Sumatran tigers and elephants, among other species, the park has a long history of agricultural encroachment.

Read more at: www.wri.org/blog/2015/07/forest-fires-blaze-indonesia

ITTO and JICA extend collaboration

ITTO Executive Director Emmanuel Ze Meka and Japan International Cooperation Agency (JICA) Director-General Kunihiko Yamauchi signed an agreement on 30 June 2015 extending collaboration between ITTO and JICA.

The agreement (formally called the "Minutes of Discussion", or MOD) aims to facilitate joint activities for the conservation and sustainable use of tropical forest resources within the context of ITTO action plans, biennial work programmes and thematic programmes and JICA's programme of work in the field of nature conservation. The MOD, which was signed at ITTO headquarters in Yokohama, Japan, is an extension of a 2010 agreement between the two organizations.

Read more at: www.itto.int/news_releases/id=4416

ITTO and APFNet launch project in Sarawak

ITTO and the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) have launched a project to promote sustainable forest management (SFM) in the Sungai Mediht watershed in northern Sarawak, Malaysia. This 35 400-hectare forest has been degraded by unsustainable logging practices, with devastating impacts on the Kelabit and Penan peoples, whose livelihoods are based on shifting cultivation, collecting and hunting.

The community-based project will work to reverse the degradation of the watershed by establishing a baseline of data on forest resources, biodiversity, traditional knowledge and socioeconomic conditions; assisting the development of community-level forest management plans; demonstrating SFM practices; establishing community-based forest management mechanisms; introducing alternative livelihoods, such as vegetable-growing, ecotourism and the raising of poultry, fish and livestock; and creating or improving village infrastructure, such as a multifunctional meeting hall, a community school, alternative energy facilities and a gravel road.

Read more at: www.itto.int/news_releases/id=4360

JLIA to maintain focus on securing verified legal wood products

The Japan Lumber Importers Association (JLIA) elected Mr Satoru Yasuda as its new chair. In accepting the post, Mr Yasuda said the focus of his term in office will be on maintaining the system to ensure the consumption of only legal wood products. The JLIA will continue to require wood-product suppliers to supply verified legal products. Mr Yasuda is managing director of Sojitz Building Materials Corporation.

Read more at: www.itto.int/mis_detail/id=4425

Brazilian wood-product exports increase in the first quarter

Brazilian timber exports grew by 20% between January and April 2015. The rise was due mainly to the effect of a weaker currency against the US dollar and because producers actively sought export markets in the face of weak domestic consumption. The Brazilian Association for Mechanically Processed Timber, ABIMCI, said that while a recovery in US demand was helping, it will be insufficient to sustain overall output because domestic consumption is falling fast.

Read more at: www.itto.int/mis_detail/id=4406

Video demonstrates Guatemala's comprehensive electronic forest information system

Guatemala's National Forest Institute (INAB) recently released a video showcasing the Electronic Forest Enterprises Information System (SEINEF), which has been established through the ITTO project TMT-PD004/11 Rev.2 (M) (see *TFU* 24/1). SEINEF is a traceability system for registering, monitoring and controlling the flow of forest products through companies that are legally established and registered in the country.

The video is available in English and Spanish at www.youtube.com/watch?v=MyhZNKVYMqU and www.youtube.com/watch?v=Ol2s7UGoB_k

Video shows master plan for sustainable management of the Douala-Edea Wildlife Reserve

The non-governmental organization Cameroon-Ecology (Cam-Eco) has released a video in French showing the steps taken under an ITTO project to sustainably manage the tropical mangrove ecosystem in Cameroon's Douala-Edea Wildlife Reserve. The reserve has been subject to a wide range of destructive uses, but ITTO project PD 492/07 Rev.3 (F): "Participatory rehabilitation and management project for mangroves and watersheds in the coastal area of the Douala-Edea wildlife reserve" is aiding Cam-Eco in developing and implementing a master plan for the sustainability of the reserve, along with income-generating activities with low environmental impact.

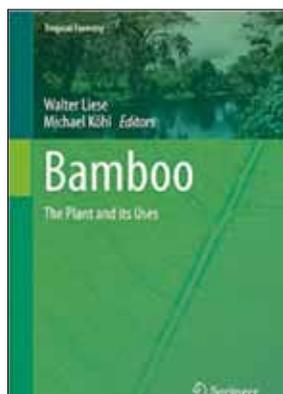
See the ITTO website at www.itto.int/project_search/detail/?proid=PD492%2F07+Rev.3+%28F%29 for a description of the project. View the video at: <https://youtu.be/a7ZcZApK4mM>

New fellowships announced

ITTO awarded 28 fellowships in the 2015 spring cycle. This newest group of fellows comes from 15 countries and includes 14 females, and the total value of the fellowships is US\$150 000. ITTO offers fellowships through the Freezailah Fellowship Fund to promote human resource development and to strengthen professional expertise in member countries in tropical forestry and related disciplines. The goal is to promote the sustainable management of tropical forests, the efficient use and processing of tropical timber, and better economic information about the international trade in tropical timber. Read more and access the fellowship network at www.itto.int/feature20.

The deadline for fellowship applications in the autumn cycle is 21 August 2015. Pending review, the results of the Selection Panel will be posted on the ITTO website by November 2015, and fellowships should commence no earlier than 1 February in the following calendar year.

Recent editions



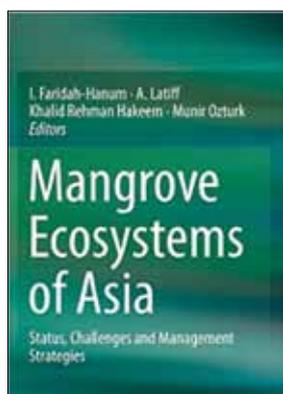
Liese, W. & Köhl, M. (eds) 2015. *Bamboo: the plant and its uses*. Springer International Publishing.

ISBN: 978-3-319-14133-6 (eBook)

Available at: www.springer.com/gp/book/9783319141329

This book presents state-of-the-art knowledge on bamboo. It introduces the plant's biology, taxonomy, habitat, morphology and

growth and discusses its silviculture, pests and diseases, and harvesting techniques. The book also includes a comprehensive presentation of the properties and uses of bamboo, and preservation treatments.



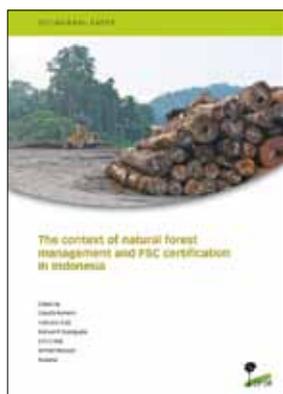
Faridah-Hanum, I., Latiff, A., Hakeem, K.R. & Ozturk, M. (eds) 2014. *Mangrove ecosystems of Asia: status, challenges and management strategies*. Springer International Publishing.

ISBN 978-1-4614-8582-7 (eBook)

Available at: www.springer.com/gp/book/9781461485810

This book provides an up-to-date account of mangrove forests in

Asia, together with restoration techniques and management requirements for these ecosystems to ensure their sustainability and conservation. The book has three sections: the distribution and status of mangrove ecosystems in Asia; their challenges, issues and opportunities; and management strategies for their conservation.



Romero, C., Putz, F.E., Guariguata, M.R., Sills, E.O., Maryudi, A. & Ruslandi (eds) 2015. *The context of natural forest management and FSC certification in Indonesia*. Occasional Paper 126. Center for International Forestry Research, Bogor, Indonesia.

ISBN: 978-602-387-002-8

Available at: www.cifor.org/library/5653/the-context-of-natural-forest-management-and-fsc-certification-in-indonesia/

The studies presented in this paper serve as a foundation for designing an evaluation framework for the impacts of Forest Stewardship Council (FSC) certification of natural forests in a participatory manner with interested parties, including institutions, organizations, communities and individuals.



Proceedings of the workshop on "assessment of forest management and REDD+ governance quality in PNG"

The "Workshop on assessment of forest management and REDD+ governance quality in Papua New Guinea" was held on 21–22 May 2015 under ITTO project PD 628/13 Rev.1 (F): "Development of quality-of-governance standards for

reducing emission from deforestation and forest degradation (REDD) in Papua New Guinea". The purpose of the workshop was to develop principles, criteria and indicators of forest governance standards.

Available at: www.itto.int/project_search (please use the project ID to find the publication)



Poynton, S. 2015. *Beyond certification*. D, Oxford, UK.

ISBNs: pdf 9781910174555

epub 9781910174548

print 9781910174531

Available at:

www.dosustainability.com/books

In this short book, Scott Poynton, founder of The Forest Trust, makes a compelling case for a new approach to social and environmental problems that goes "beyond certification".

Certification emerged from the 1992 Rio Earth Summit amidst great hope. Since then, despite a proliferation of certification schemes in 25 industry sectors, the destructive exploitation of natural and human resources has worsened.

Beyond certification reviews the positive aspects of certification, of which there are many, but argues that we can no longer afford to gloss over its failures.



FAO 2015. *Forests, trees and disasters*. *UnASYLVA* 66: 243/244.

Available at:

www.fao.org/3/a-i4447e.pdf

This double edition of *UnASYLVA* teases out the complex interrelationships between forests, trees and disasters and examines the ways in which forests and trees can best be managed to resist and protect from shocks. The edition was published to coincide with the

World Conference on Disaster Risk Reduction, held in Sendai, Japan, on 14–18 March 2015. It covers a range of disasters and crises, especially natural disasters but also human-induced disasters and other complex crises.

Meetings

19–23 August 2015

New Frontiers of Forest Economics: Forest Economics Beyond the Perfectly Competitive Commodity Markets

Beijing, China
Contact: shashi.kant@utoronto.ca;
<http://neffe.nsd.edu.cn>

23–30 August 2015

Sustaining Ecosystem Services in Forest Landscapes: Concepts, Research, and Applications

Tartu, Estonia
Contact: sandra.luque@irstea.fr;
<http://iufrole2015.to.ee>

1–4 September 2015

A Global Perspective on the Ecology and Management of Bark and Wood Boring Insects

Bariloche, Argentina
Contact: Barbara J. Bentz,
bbentz@fs.fed.us; www.iufro.org/fr/science/divisions/division-7/70000/70300/70305/

7–11 September 2015

XIV World Forestry Congress

Durban, South Africa
Contact: WFC-XIV-Info@fao.org;
www.fao.org/forestry/wfc/en/

7–10 September 2015

ITTO side-events at the XIV World Forestry Congress

ITTO will host four side-events:

7 September: Voluntary Guidelines for the Sustainable Management of Natural Tropical Forests

8 September: ITTO–CITES Programme

9 September: Mangrove Forests and Ecosystems—Opportunities and Challenges for their Future

10 September: Electronic Tools for Ensuring Timber Legality and Wood Utilization.
Contact: www.itto.int/workshop_detail/id=4422

9–11 September 2015

Ecobuild Southeast Asia

Kuala Lumpur, Malaysia
Contact: www.ecobuildsea.com

9–11 September 2015

Wilder By Design? Managing Landscape Change and Future Ecologies

Sheffield, UK
Contact: info@hallamec.plus.com; www.ukeconet.org/events/event/wilder-by-design

15–16 September 2015

5th China Global Wood Trade Conference

Shanghai, China
Contact: www.gwtchina.org

16–18 September 2015

6th International Hardwood Conference

Copenhagen, Denmark
Contact: info@ihc2015.info;
www.ihc2015.info

September 30–1 October 2015

Second International Conference on Community Land and Resource Rights

Bern, Switzerland
Contact: conference@rightsandresources.org

September 30–1 October 2015

17th St Petersburg International Forestry Forum

St Petersburg, Russian Federation
Contact: Andrei Vladimirovich Afanasiev, afanasiev@restec.ru;
<http://spiff.ru>

6–7 October 2015

Timber Expo 2015

Birmingham, UK
Contact: www.timber-expo.co.uk

13–17 October 2015

Linking Ecosystem Services to Livelihood of Local Communities

Republic of Korea
(Seoul, 13–14 October; Naju-si, 15 October; Gurye, 16 October)
Contact: min34071@gmail.com;
selenium78@krei.re.kr

14–16 October 2015

ATIBT Forum: Tropical Wood Feeding the Future

Milan, Italy
Contact: www.atibt.org/milan-2015-en/4588983445

12–16 October 2015

6th International Wildland Fire Conference

Pyeongchang, Republic of Korea
Contact: www.fire.uni-freiburg.de/course/meeting/2015/meet2015_02.htm html#

15 October 2015

Side-event at the 6th International Wildland Fire Conference: ITTO'S Field Work on Integrated Forest Fire Management in the Tropics—Best Practices and Lessons Learned on Fire Management in Tropical Forests. Starting at 12:00 p.m.

Contact: www.itto.int/workshop_detail/id=4423

19–20 October 2015

7th Palm Oil and Rubber Summit

Krabi, Thailand
Contact: friyana@cmtsp.com.sg;
www.cmtsevents.com/eventschedule.aspx?ev=151026&

19–23 October 2015

22nd Meeting of the CITES Plants Committee

Tbilisi, Georgia
Contact: www.cites.org/eng/news/calendar.php

21–24 October 2015

Scientific Cultivation and Green Development to Enhance the Sustainability of Eucalypt Plantations

Nanning City, China
Contact: sxchen01@163.com;
www.iufro.org/events/calendar/current/

26 October 2015

18th RRI Dialogue on Forests, Governance, and Climate Change

Washington DC, USA
Contact: dialogue@rightsandresources.org; <http://rightsandresources.us10.list-manage.com/track/click?u=aa5c546f8cc4973feaf2608d9&id=e687c56921&e=3eb9466d7a>

28–31 October 2015

Eco Expo Asia

Hong Kong, China
Contact: www.ecoexpoasia.com;
ecoexpo@hongkongmessefrankfurt.com

3–5 November 2015

Managing Forests to Promote Environmental Services: Climate Change Adaptation and Mitigation, Water Protection, Biodiversity Conservation, and Soil Quality Maintenance

Copenhagen, Denmark
Contact: <http://ign.ku.dk/english/outreach-publications/conferences-seminars/car-es-final-conference/>

5–6 November 2015

7th International Symposium of Indonesian Wood Research Society

Bandung, West Java, Indonesia
Contact: iwors2015@mapeki.org;
www.itto.int/workshop_detail/id=4240

16–21 November 2015

51st Session of the International Tropical Timber Council and Associated Sessions of the Committees

Kuala Lumpur, Malaysia
Contact: itto@itto.int; www.itto.int/workshop_detail/id=4240

16–21 November 2015

3rd European Forest Week and the 72nd Joint Session of the ECE Committee on Forests and the Forest Industry

Engelberg, Switzerland
Contact: paolo.cravero@unece.org;
<http://forests-l.iisd.org/events/silva2015-and-third-european-forest-week/#more-249570>

30 November–

11 December 2015

21st Session of the Conference of the Parties and 11th Session of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol

Paris, France
Contact: www.cop21.gouv.fr/en

2–3 December 2015

Log Trade Trends: a Global Perspective

Portland, Oregon, USA
Contact: <http://logtradetrends.worldforestry.org>

21–23 April 2016

PERCEPTION–PREDICTION–ACTION: Managing Risk in Uncertain Times

Istanbul, Turkey
Contact: http://riskanalysis-iufro.org/2016Meeting_Announcement.pdf

25–29 April 2016

Global Change and Forest Health—Climate Change, Biological Invasions, Air Pollution, Forest Pathology, Forest Entomology, and Their Interactions

IUFRO All-Division 7 Conference
Istanbul, Turkey
Contact: eckehard.brockerhoff@scionresearch.com

15–19 August 2016

15th International Peat Congress

Kuching, Malaysia
Contact: peat2016@gmail.com;
www.ipc2016.com

24 September–5 October 2016

17th Meeting of the Conference of the Parties to CITES

Johannesburg, South Africa
Contact: www.cites.org

12–14 October 2016

Mexico's Forestry Expo

Guadalajara, Mexico
Contact: expoforestal@conafor.gob.mx; www.expoforestal.gob.mx

