Sustainable Forest Management

By Jim Ball, Chair, Commonwealth Forestry Association

Sustainable Forest Management (SFM) has been defined as: "The process of managing permanent forest land to achieve one or more clearly specified objectives of management with regard to the continuous flow of desired forest products and services without undue reduction in its inherent values and future productivity and without undue undesirable effects on the physical and social environment" (ITTO, 2006).

The concept of SFM, which arose from the UN Conference on Environment and Development (UNCED) in 1992, thus includes social and environmental dimensions besides the economic aspects. This chapter therefore covers all aspects of SFM including not only conventional management for sustainable outputs but also the involvement of communities in management as well as the conservation of forest biological diversity and forest protection.

Management of the Production Tropical Permanent Forest Estate in some ITTO Member Countries, 2005 (% of area) TABLE 2.1

Country	*Natural forest*		*Plantation*	
	Licensed concessions	*With management plan*	*Sustainably managed*	*With management plan*
Africa				
Cameroon	56	20	6	n.a.
Ghana	90	100	23	100
Nigeria	39	24	n.a.	47
Asia & Pacific				
Fiji	n.a.	n.a.	n.a.	80
India	100	72	36	25
Malaysia	61	100	43	100
Papua New Guinea	64	57	17	n.d.
Vanuatu	n.d.	0	0	100
Americas				
Guyana	70	68	10	0
Honduras	67	42	12	58
Trinidad & Tobago	59	59	12	100

Derived from ITTO, 2005; n.a. = not available; n.d. = no data.

Forest management

The development of SFM

The importance of forests for the sustainable supply of goods (not only timber, but also firewood) and services, especially watershed protection, had been recognised by the end of the 19th century. Forest reservation by national governments, which included both physical demarcation of boundaries as well as the control of logging, had started in India since the First India Forest Act of 1862 and continued in Burma (now Myanmar) and subsequently in Straits Settlements (now Malaysia). It was the main forestry activity in colonial Africa and the Caribbean in the 1920s, 1930s and into the 1950s.

The first management systems for tropical forests were those developed for teak forests in India and Burma (Myanmar) from the mid-19th century (Dawkins and Philip, 1998), while plantation techniques were developed for many other countries. But silvicultural systems for the management of other tropical moist forest types, such as the Malayan Uniform System, the Timber Stand Improvement of Uganda (also a uniform system) and the Tropical Shelterwood System of Ghana were not developed until the 1950s and 1960s. They combined yield control by minimum girth/diameter limits and the poisoning of "weed" trees to liberate the "desirable" species for which there was a market. Twenty years later these systems were no longer used for a number of reasons, including high costs and lack of staff, while a study of the effects of harvest regulations in Ghanaian forests did not find increased regeneration or a balanced size-class distribution arising from nine decades of their application (Asamaoah Adam *et al*., 2006).

By the 1980s the sustainable management of tropical moist forest appeared to be almost non-existent and the permanency of the forest estate, the basis of sustainable management, was often threatened. An

LEFT
The concept of sustainable forest management arose from UNCED.

ITTO report showed that a very small area was, even in theory, under sustainable management (Poore *et al*., 1989). But ITTO has subsequently issued a new report (ITTO, 2005) that gives a more encouraging picture. There has evidently been progress since 1989, when the authors had trouble finding even 1 M ha of sustainably managed natural forests. Instead at least 25 M ha were identified, and India and Malaysia alone accounted for 40% of that.

The criteria for SFM used in the ITTO study were the proportion of the forest area with valid licensed concessions, a current management plan or being sustainably managed according to the ITTO assessors. The study found that many more forests had management plans, but only 7% of the 352 M ha of the natural forests in tropical countries which were stated to be managed to produce timber, were in fact being managed sustainably. Many companies with management plans do not actually follow them and much of the tropical timber on the market comes from illegal sources. *Table 2.1* and *Annexes 3.1* and *3.2* show the situation of the management of the Permanent Forest Estate[1] (PFE) in the 11 Commonwealth countries that are ITTO members.

Management of the PFE with production functions in the 11 Commonwealth ITTO countries shows that there are high proportions of licensed concession and of forests with management plans, both in natural forest and plantation, although the area of natural forest believed to be sustainably managed is low.

Information on the presence of management plans in other Commonwealth countries is summarised in *Table 2.2*.

There are some unexplained discrepancies between the 2005 data in *Table 2.1* and that of 2010 in *Table 2.2*, notably for Fiji, Ghana, Malaysia, Nigeria and India. Whatever the reason for these differences, it does appear that most Commonwealth countries have a high proportion of their forests under working plan.

1 Areas declared by governments to be permanently devoted to the practice of forestry – although they may not always have forest cover.

Forest with Management Plan in Commonwealth Countries, 2010 TABLE 2.2

Country	Management plan (% of forest area)
Africa	
Cameroon	39
Gambia	16
Ghana	20
Kenya	24
Lesotho	7
Mauritius	23
Mozambique	2
Namibia	8
Nigeria	41
Sierra Leone	3
South Africa	23
Swaziland	19
Tanzania	85
Uganda	35*
Zambia	23
Americas	
Belize	74*
Canada	70*
Guyana	36
Honduras	15*
Jamaica	13*
South Asia	
Bangladesh	60
India	45
Sri Lanka	100*
South-east Asia & Pacific	
Australia	21
Fiji	1
Kiribati	2
Malaysia	45
New Zealand	84
Papua New Guinea	17*
Singapore	100
Tonga	22
Europe	
Cyprus	62
Malta	100
UK	65

Source: FRA2010 and *2000 where data not reported in 2010.

Criteria and indicators

Criteria and indicators (C&I) processes arose from UNCED in 1992. They aim to contribute to sustainable forest management through the definition of its attributes (criteria) and the measurement of progress (indicators).

There are nine International Processes on Criteria and Indicators for SFM, involving 150 countries, some of which are members of more than one Process. Forty-one Commonwealth countries are members of eight of the Processes (*see Annex 3.3*).

Certification

Certification is a procedure by which written assurance is given that a product, process or service is in conformity with certain standards of good practice (ISO, 1996). Most of the certification schemes in forestry are third-party verification schemes, under which an independent assessment of forest management is carried out by an accredited third party, either against defined processes or systems, or against the outcome or the quality of goods and services measured against defined standards.

The main certification scheme used in the Commonwealth is that of the Forest Stewardship Council (FSC, www.fsc.org), but there are four national schemes: the Australian Forest Certification Scheme (AFCS, www.forestrystandard.org.au), the Canadian Standards Association (CSA, www.shopcsa.ca), the Malaysian Timber Certification Scheme (MTCS, www.mtcc.com.my) and the UK Woodland Assurance Standard (UKWAS, www.ukwas.org.uk), which is not a certification scheme but provides a single common standard for use within those forest certification programmes that operate in the UK – largely the FSC and the Pan-European Forest Process (PEFC). There is also a North American scheme, the Sustainable Forestry Initiative (SFI, www.aboutsfi.org), which is used by Canada. New Zealand has established its own National Standard, which is subject to independent verification.

An approximate estimate of the area of forest presently certified in Commonwealth countries, derived from *Table 2.3*, is 170 M ha in 2009, or nearly 21% of the Commonwealth's total forest area. It is mainly natural forest but also planted forests – *see Chapter 1*.

It remains to be seen whether this rapid rate of increase will be maintained, but recognition of certified products by the general public is probably increasing; for example a public opinion survey carried out by the UK Forestry Commission in 2005 showed that 44% of respondents had been shopping for wood products in

the last few years and of these respondents, 38% recognised the FSC symbol and 8% recognised the PEFC symbol (Forestry Commission, 2005).

Participatory forest management

A significant shift in thinking in the last 20 years about the management of all types of forests has been the development of participatory processes, which has involved reduction in centralised government management of forests. It has often been accompanied by political decentralisation or devolution of responsibilities[2]. A great many Commonwealth countries have reported experience in developing and implementing community and participatory management schemes.

India, which has a long history of local participation in forest management, was among the first to formalise the arrangements for community involvement in recent years, with the concept of Joint Forest Management (JFM) in 1990 (Bahuguna, 2005 and Singh, 2006). Before then the previous Social Forestry and Wastelands Programme, which had aimed to support reforestation under the supervision of the authorities, had failed to arrest deforestation and degradation. The objective of JFM was still to rehabilitate depleted state forests but with the direct involvement of forest-dependent communities in their protection and management, although the government has retained ownership of the land (Singh, 2006, gives a very full account of the development of participatory forest in India).

The criticism has been made that bureaucratic attitudes still influence the implementation of JFM. A recent study of several hundred senior and middle-level managers of four state forest services which are implementing JFM shows a disparity between the participatory ethos of JFM and the value system of bureaucracies (Kumar and Kant, 2003). The study points out that the implementation of a participatory policy requires also the reform of legal and administrative frameworks, while a study in Cameroon notes the need for conflict resolution between the various interests. Before decentralisation such conflicts were vertical – between social classes – afterwards they were horizontal – within social classes (Madingou, 2003).

Such conflicts relate to the problems that have been experienced in ensuring that all members of a community have a voice and a share of the benefits. "Is community forestry really benefiting those who are most in need and those who continue to

Forest Areas Certified for Some Commonwealth Countries, 2000-2009 TABLE 2.3

Country	*Area certified (000 ha)*		
	2000	*2005*	*2009*
Australia	0	6,280	10,455
Belize	0	96	105
Cameroon	0	0	879
Canada	4,360	119,800	146,000
Guyana	0	0	372
India	0	0	644
Kenya	0	0	2
Malaysia	55	966	4,144
Mozambique	0	0	71
Namibia	0	0	328
New Zealand	363	620	1,047
Papua New Guinea	0	0	41
Solomon Islands	0	0	39
South Africa	828	1,169	1,638
Sri Lanka	0	13	23
Swaziland	0	101	117
Tanzania	0	0	36
Uganda	0	0	204
UK	958	1,500	1,576

Sources: FSC, AFCS, Canadian Forest Service, MTCC and UKWAS websites.

2 Decentralisation refers to the shift of power to a lower level, often within the same organisation. Devolution refers to the shift of power out of the original organisation, generally to a lower level. The latter is the sounder basis for participatory management.

struggle with marginalisation and exclusion?" asked Campbell (2009).

But participatory forestry is not only about wood supplies, forest conservation or social equity as described in *Box 2.1*. Akumsi (2003) has described a project in Cameroon (supported by the UK) in the development of community participation in wildlife management, including the lucrative bushmeat trade, while Mozambique has revised forest policy and laws to create an environment to enable community forestry and wildlife management in 61 community-based pilot initiatives. (Mansur and Zacarias, 2003).

The management of woods by communities is by no means confined to developing countries. The UK started to facilitate the management of former State-owned woodland by communities 20 years ago, and now three different forest strategies have developed. In England "community forestry" refers to the management of new and existing woodland in areas of urban regeneration for public benefit. In Scotland social activism and policy changes have led to a twofold model of urban regeneration, and community ownership and enterprise in rural areas. In Wales it has been led by rural communities with project funding (Lawrence *et al*., 2009).

The Impacts of Two Types of Participatory Forest Management BOX 2.1

Participatory Forest Management (PFM) has been promoted throughout Tanzania as a means of achieving conservation and improving livelihoods. A study of nine villages in the Eastern Arc Mountains investigated the impacts of two institutional forms of PFM – Joint Forest Management (JFM) and Community-Based Forest Management (CBFM) – on the livelihoods of different well-being groups within communities. PFM was found to provide a new, though small, source of community-level income that was used to improve community physical capital. Household incomes from PFM forests generally increased slightly for most groups. However, technical and administrative obstacles prevented the poorest from taking full advantage of the benefits of forests under CBFM, while benefits from JFM-related income-generating activities were captured by village élites. Overall, the results suggested that PFM implementation has improved forest conservation but has not realised its potential to contribute to poverty reduction or social exclusion and, in the case of CBFM, may even be increasing the gap between rich and poor.

Source: Vyamana, 2009.

Some recent Commonwealth initiatives in SFM

There are two important global initiatives led by Commonwealth countries in forest management: the Iwokrama International Centre for Rain Forest Conservation and Development, and the Canadian Model Forest Program.

The Iwokrama International Centre for Rain Forest Conservation and Development (IIC) is located in Guyana and is supported by the Commonwealth. It originated in an offer in 1989 – a time of intense global debate on tropical rain forests – by the then President of Guyana to the Commonwealth Heads of Government Meeting (CHOGM) in Malaysia. An Agreement, made at the CHOGM of 1995, defined the objectives, functions and organisation of Iwokrama, and this Agreement formed part of the enabling legislation which was subsequently passed by the Guyanese Parliament in 1996.

The IIC, which is dedicated "to develop, demonstrate, and make available to Guyana and the international community systems, methods and techniques for the sustainable management and utilisation of the multiple resources of the tropical forest and the conservation of biological diversity", is an autonomous non-profit institution. It manages the Iwokrama Forest of nearly 371,000 ha in central Guyana with the aim of demonstrating how tropical forests can be conserved and sustainably used to provide ecological, social and economic benefits to local, national and international communities. In its vision the IIC states that: "By 2010,

BELOW
The Iwokrama International Centre for Rain Forest Conservation and Development in Guyana is supported by the Commonwealth.

IIC intends to become the leading international authority on development of models for commercially sustainable, practical and community-inclusive conservation businesses based on tropical forests and their natural assets". The IIC mission is "to promote conservation and the sustainable and equitable use of tropical rainforests in a manner that will lead to lasting ecological, economic and social benefits to the people of Guyana and to the world in general by undertaking research, training and the development and dissemination of technologies".

There are programmes on: Climate Change; Sustainable Forest Management; and Eco-tourism – and cross-cutting support programmes on: Research, Monitoring and Evaluation; Information and Communications; and Stakeholder Processes and Governance. In order to implement the programmes the Centre follows collaborative and cooperative approaches with a wide range of local, national and international organisations, and promotes participation by local communities and other stakeholders in management and all research and development programmes. It aims to use indigenous knowledge and practices: in the development of sustainable management systems; to promote human resource and institutional development for capacity building; to offer education and training; and to make contributions to national and forest policy development, in Guyana, and globally.

The first phase of Iwokrama's research focused on the collection of baseline information to support management planning. Now Iwokrama is engaged in three large projects which build on the baseline information to provide a more holistic approached to cover all the ecosystem services that the forest provides. They are: the Forest Research Network; the Guiana Shield Initiative; and a programme focused on capacity building to support national initiatives in reducing deforestation and degradation in Guyana.

The International Model Forest Network: A Global Learning Network for Working-level Solutions to Sustainable Forest Management

By Peter Besseau, Christa Mooney and Nicolas Duval-Mace
International Model Forest Network Secretariat

The question of how to involve different interest groups as active partners in finding working solutions to the many challenges of sustainable forest and landscape management inspired the creation of Canada's Model Forest Program in the early 1990's. In Canada, this was a period when the paradigms that had until then largely guided forest planning and management – generally via a partnership of government and industry - were being challenged by new voices and a more diverse set of forest values seeking to be part of the process of determining the future of forests. This transition continues in different degrees around the world today.

A Model Forest is a place, a partnership and a process. The place is a landscape or ecosystem-scale area; the partnership is voluntary and inclusive, from national policy makers to local farmers; and the process is a journey of dialogue, experimentation, and innovation designed to understand what "sustainability" means within a given landscape and then to use the partnership to work toward it. While the process must involve sound technical and scientific inputs, a considerable part of it involves understanding one another, the demands that we place on an ecosystem, and the tradeoffs involved in the choices we make. On that basis it is possible to make more informed choices, to draw fully from the intellectual capital represented by a rich and varied partnership, and, ultimately to make better choices.

Model Forest Principles

Interest in the Model Forest concept outside of Canada led to Canada's announcement of the International Model Forest Network at UNCED, in 1992, which was followed by establishment of its Secretariat in Ottawa, in 1994. From an initial 10 sites in Canada and three sites abroad, the IMFN today has grown to include nearly 30 participating countries and close to 50 Model Forests around the world. While Model Forests represent extremely varied landscapes, forest types, political jurisdictions, and cultures, they all share a common, agreed-upon set of principles:

- Broad based, inclusive, voluntary partnerships
- A land base large enough to incorporate a broad range of forest uses and values, including social, economic and environmental concerns
- A commitment by all partners to work collaboratively in support of the conservation and sustainable management of natural resources and the forested landscape
- A governance structure that is representative, transparent and accountable to its members
- A program of work reflective of its partners' needs and values
- A commitment to knowledge sharing, capacity building and networking by sharing know-how and expertise with others

The sixth principle underpins the justification for a network of sites. Membership in the IMFN is designed to allow for the efficient movement of knowledge and know-how to accelerate innovation between Model Forests, and support and encourage opportunities for learning. Overseeing development of the Network is the IMFN Secretariat based at and supported by Natural Resources Canada's Canadian Forest Service in Ottawa. Funding for the Secretariat and some program support is also provided by the International Development Research Centre (IDRC). Within the countries in which they are hosted Model Forests are the responsibility of the lead forest agency at a national or sub-national level: they provide the enabling environment, the financial support, and the political opportunity for such partnerships to convene and actively contribute to share ideas, perspectives, and opportunities for action around the sustainability challenge. Together with our partners around the world, one of the Secretariat's key objectives is ultimately to realize a dynamic global learning network that demonstrates concretely how landscapes and ecosystems can be managed on a sustainable basis through inclusive partnership arrangements.

What do Model Forests Do?

At the local level, Model Forests bring diverse forest stakeholders together — particularly those who have traditionally been left out of the decision-making process — to openly discuss, plan, test and implement sustainable solutions to pressing economic, social and environmental issues. Frequently, the Model Forest partnership represents the only forum in a given region that draws together such varied stakeholders. It is also often the only forum through which the high-level policy objectives of SFM are translated into ideas and tasks that are accessible and do-able at the landscape level.

The program of activities found in Model Forests varies considerably across the Network because each stakeholder group defines what sustainability means in their particular context, and sets its own priorities. However, there are many common threads across the IMFN, including: education, forest science,

research, biodiversity conservation, sustainable economic development and participatory governance, among others.

Local Implementation, Global Reach

While each Model Forest operates at the local level it simultaneously engages at the national, regional and global levels through membership in the IMFN and its various Regional Networks. In this capacity, key international forest issues, such as climate change, forest degradation or loss of biodiversity can be examined at a range of scales through coordinated research agendas or joint projects.

For example, the IMFN is currently exploring joint work in the area of in climate change vulnerability and adaptation research in sites across the boreal north linked through Model Forest communities and others. Elsewhere, an analogue forestry project involving five Model Forests in Latin America is examining biodiversity restoration and enhanced rural livelihoods. In addition, Model Forests in the Mediterranean have expressed an interest in exploring issues such as forest fires and natural disturbances as common elements in their collaboration, while ongoing development of an African Model Forest Network is expected to result in decreased forest degradation and increased economic opportunities.

The theme of the 18th Commonwealth Forestry Conference, forest restoration, is also an area in which Model Forests are active. In Russia, the Kovdozersky Model Forest is looking at approaches, methods and technologies for forest restoration. In Argentina, the Formoseño Model Forest is working to protect and enrich forest cover with native species of high cultural value that also produce livestock forage. And in Brazil, Pandeiros Model Forest is establishing tree nurseries and reforesting degraded lands for soil conservation and regeneration of endemic vegetation.

Globally, the IMFN Secretariat leads Network-wide initiatives focused on climate change, ecological goods and services, community sustainability and the development of an Internet-based market for sustainably produced goods in Model Forests as a way to support resource-based communities over the long-term.

Whether involved in local, regional or trans-boundary natural resource planning, Model Forests have demonstrated that both local stakeholders and decision makers at all levels must be an active part of the process of defining and delivering solutions on the ground. Ultimately, the range of issues that Model Forests address are not just developed or developing country issues; they are familiar in all our landscapes. Therefore both the range of issues considered and the options for addressing them are substantially enriched through broad-based local partnerships and their interaction with the broader IMFN global community of practice.

For more information on the International Model Forest Network, please visit www.imfn.net.

The International Model Forest Network (IMFN) is a global Community of Practice whose members work towards a common goal: the sustainable management of forest-based landscapes. The IMFN is made up of more than 50 Model Forests and 30 member countries across five continents.

Model Forests are based on a flexible approach that combines the social, cultural and economic needs of local communities with the long-term sustainability of large landscapes in which forests are an important feature. By design they are voluntary, broad-based initiatives, linking forestry, research, agriculture, mining, recreation, and other interests within a given landscape. While each Model Forest sets its own priorities, common themes found across the IMFN include biodiversity, conservation, forest restoration, sustainable economic development, education and good governance. These common themes form the basis for networking, learning, and innovating from local to global levels.

To learn more about the IMFN visit www.imfn.net

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Iwokrama offers a model of forest governance and management which has been widely recognised. Its achievements include:

- Increased understanding of the options for sustainable forest business, including agreements on international property rights and benefit sharing. A study of the carbon sequestration potential of Guyana's forests was carried out – which suggests that this potential benefit may be less than had been thought. Studies on reduced-impact logging and on market feasibility for timber and non-timber products have been made and certification of the outputs from the forest has begun.
- Systems and institutional capacity have been developed for collaboration with local people.
- Partnerships have been established for natural resource management with a wide range of agencies, NGOs and institutions at national and international levels.
- The ecosystems of Iwokrama itself are better understood through research, including the documenting of local knowledge.
- Forest stakeholder capacities and skills have been raised.
- Public outreach programmes have been developed.

A description of the work of the Iwokrama Centre is available on www.iwokrama.org and detailed information on some of its programmes was included in *CFA Newsletter,* No. 34 of September 2006. Support from the countries of the Commonwealth for Iwokrama was specifically mentioned in the Commonwealth Climate Change Action Plan, issued by the CHOGM in 2007[3] and investment as Payment for Environmental Services (PES) in Iwokrama was described in *CFA Newsletter,* No. 41 of June 2008.

The second initiative in forest management of global significance is Canada's Model Forest Program, which was launched in 1992. It emphasises the importance of engaging people with a direct interest in the forest in all aspects of forest management. According to the website, "A Model Forest is both a geographic area and a specific partnership-based approach to SFM". There are three basic elements underlying the Program: relevance to local values and needs; diverse and dynamic partnerships; and SFM. Science and technology support decision-making, along with education in the theory and practice of sustainable management. There are 14 Model Forests in Canada covering 19.8 M ha (see www.modelforest.net).

The Canadian Government announced at UNCED in 1992 the formation of the International Model Forest Network (IMFN), with the following goal: "To support, through Model Forests, the management of the world's forest resources in a sustainable manner, reflecting environmental and socio-economic issues from the perspective of local needs and global concerns". The IMFN now comprises 21 sites in 14 countries other than Canada, covering 8 M ha (see www.imfn.net). A further eight countries, including India, are exploring the possibility of joining. Networking and learning from one another has been fundamental to the success of the Program.

The Canadian International Development Agency (CIDA) has supported the IMFN with over C$3 million to date, while the International Development Research Centre (IDRC) has supported the Secretariat with over C$2.5 million, and benefits in kind.

Some common features of the approaches in JFM, model forests and Iwokrama are:

- Participation by local and other stakeholders is essential;
- Capacity-building is required for effective stakeholder involvement;
- Research is needed to develop models of sustainable management, but traditional knowledge may be as important as science;
- There has to be acceptance of the need for management by both the people and the government;

3 See www.thecommonwealth.org/document/34293/35144/173014/climateactionplan.htm.

LEFT
A meteorological station in a Model Forest Special Project Area in Canada's Yukon.

- Policy and administrative reforms are required, with reorientation of the attitudes of the staff of the forest service.

Other developments in SFM of natural forests

The ecosystem approach, which developed from the CBD, addresses the management of biological diversity in a range of ecosystems. An examination of the this concept and SFM by Løyche Wilkie *et al*. (2003) concluded that although they evolved separately (the former from UNCED, the latter from the meetings of parties to the CBD) both aim at "promoting conservation and management practices which are environmentally, socially and economically sustainable and which generate and maintain benefits for both present and future generations". Furthermore, "The few conceptual differences between the two sets of principles (which guide the two approaches) stem from different starting points (production forests and forest management versus conservation ecology) but are minimal for practical purposes".

Linked to the ecosystem approach is Close to Nature Forestry (CNF), described in a recent review by Bruenig (2009). The reviewer summarised CNF as an essential and very practical feature of an ecosystem-orientated management system for the conservation of natural, near-natural and plantation forest. He stated that it is neither an esoteric concept of foresters nor an abstruse philosophy of nature lovers nor a rigid and old fashioned silvicultural dogma.

Another recent development relates to Reduced Impact Logging (RIL) one of the techniques for tropical moist forest management. RIL includes directional felling, pre-exploitation climber cutting and the use of

logging arches. RIL helps provide suitable conditions for regeneration and also protects the site.

Planted forests

Plantations or planted (enriched) semi-natural forest, now known collectively as planted forests (*see Chapter 1*), are crucial to the various developments in forest management described above. Most of the popular resistance to plantations of 15 or 20 years ago has been rationalised through better understanding of the need for planted trees to meet supplies of wood and fibre and greater sensitivity by plantation managers towards the rights of local people. The eucalyptus controversy has subsided, through widespread selection of the species for planting by farmers and communities, and also better understanding by extension workers of the need to match species to site and to adjacent agricultural practice. The feared loss of growth and yield of plantation crops grown in succession on the same site has been investigated in plantations of *Pinus patula* in Swaziland up to four rotations (Evans, 2005) and no loss of growth or yield has been found. Further research is, however, still needed into other sites and other species.

Some high-value hardwoods have always been grown in plantation, teak (*Tectona grandis*) being the best-known example. But recently possible shortages of luxury hardwoods led to a UK-funded project to investigate the then current situation in the 1990s and to make predictions and recommendations for the future (Varmola and Carle, 2002). Ghana, Fiji and the Solomons are examples of Commonwealth countries growing high-value hardwoods, where fast growth rates for certain species, such as *Terminalia spp.* or *Swietenia macrophylla,* combined with incentives, make up for the relatively long rotations.

Guidelines for management

The growth in planted forest area has led to the development of guidelines, such as the Voluntary Guidelines for Responsible Management of Planted Forests (FAO, 2006). A national example is the Tree Planting Guidelines for Uganda, prepared by Uganda's Sawlog Production Grant Scheme, providing practical science-based advice for growing timber plantation crops by non-foresters. It is available on the SPGS website, www.sawlog.ug.

Forest Landscape Restoration – the bigger picture

A further development, in which Commonwealth countries are playing a part, is the idea of Forest Landscape Restoration (FLR), which urges us to see the bigger picture and puts forest and woodland in the context of the wider landscape. FLR means restoring the goods, services and ecological processes that forests can provide at the broader landscape level rather than solely promoting increased tree cover at a particular location (www.iucn.org/themes/fcp/.htm).

The elements of FLR include:

- Restoring the benefits of the forest to people in terms of products and services, at the same time as the environmental functions of forests;
- Connecting forest fragments between protected and well-managed forest areas by "forest corridors";
- Reducing the vulnerability of forests to threats (such as pests or fires or climate change);
- Planning, identifying and addressing solutions acceptable to all and the root causes of forest loss and degradation; and
- Valuing forest goods and services in order to quantify and evaluate how stakeholders can benefit from them.

An example of landscape restoration by means of forest corridors is from the Kinabatangan River in Malaysian Borneo. There the World Wide Fund for Nature (WWF) is working with the owners of oil palm plantations to restore the forest corridor that used to run along the river. It is hoped that this will help con-

serve such rare species as the Asian elephant, the orang-utan and the Sumatran rhinoceros which will contribute to the livelihoods of the neighbouring people through helping to conserve these species which are the "stars" of the local eco-tourism industry.

The Forest Landscape Restoration Implementation Workshop, held in Petrópolis in April 2005, was organised by the Global Partnership on Forest Landscape Restoration (GPFLR) – a network of governments, organisations, communities and individuals of which IUCN, WWF and the UK Forestry Commission are founder members. The workshop concluded with the agreement on the Petrópolis Challenge, which defined FLR as "a vehicle for delivering internationally agreed commitments on forests, biodiversity, climate change and desertification", and identified its key role in achieving the Millennium Development Goals. The Challenge noted that there is no blueprint for successful forest landscape restoration, but highlighted examples of its role in restoring key goods and services in degraded or deforested lands to improve livelihoods in several countries. For more information see, www.unep-wcmc.org/forest/restoration/globalpartnership.

An assessment of the potential land available for restoration was presented by the GPFLR at an international meeting in London in December 2009. For more information on the meeting and other work of the Partnership see: www.ideastransformlandscapes.org. Satellite imagery has been interpreted to produce a global map identifying more than a billion ha of former

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Involving local people from the outset is key to the success of forest restoration projects – villagers in northern Tanzania discuss the Hashi Forest project.

Management of the Protection Tropical Permanent Forest Estate in some ITTO Member Countries, 2005 (%) TABLE 2.4

Country	*Attribution to IUCN Cat I-IV*	*For soil and water protection*	*With management plan*	*Sustainably managed*
Africa				
Cameroon	68	n.d.	n.d.	n.d.
Ghana	49	n.d.	n.d.	108
Nigeria	100	n.d.	n.d.	n.d.
Asia & Pacific				
Fiji	1	7	15	23
India	12	n.d.	n.d.	n.d.
Malaysia	44	100	100	100
PNG	21	n.d.	n.d.	n.d.
Vanuatu	0	n.d.	n.d.	n.d.
Americas				
Guyana	100	n.d.	25	25
Honduras	27	n.d.	n.d.	n.d.
Trinidad & Tobago	49	n.d.	20	n.d.

Derived from ITTO, 2005; **n.d.** = no data.

forest land and degraded forest land with restoration potential – about 6% of the world's total land area. The previous potential restoration area was believed to be no more than 850 M ha. The GPFLR believes that restoring forests to some of these lands could be achieved without prejudicing other vital land uses, such as food production, while providing livelihoods and absorbing carbon. The GPFLR will now work with individual countries and local communities to deliver restoration where communities benefit and it is also carrying out an economic appraisal of three key elements of FLR projects worldwide to determine financial flows, economic flows and equity. Commonwealth countries involved include Malaysia (Sabah), Uganda, Tanzania and the UK.

Distribution of Botanic Gardens in the Commonwealth, 2006 TABLE 2.5

Region	*Number of botanic bardens*
Africa	88
Americas	122
South Asia	145
South-east Asia & Pacific	168
Europe	106
Total	629

Source: BGCI, 2006.

Conservation

Responsible forest management incorporates not only wood production but the conservation of the site and its biological diversity. Most Commonwealth countries have set aside protected areas with the aim of protection of forest ecosystems. They may perform many functions, including the conservation of biological diversity, the provision of vital services, such as the protection of watersheds and soils and of human communities from natural disasters. Many are important to local communities, especially indigenous peoples who depend for them for a number of resources. They often protect places of cultural importance or provide tranquillity; some are important for research and education while others can contribute to local economies through eco-tourism.

IUCN defines a protected area as: "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means". A description of the six IUCN protected area categories is at *Annex 3.5*.

In a report on progress towards the CBD's 2010 and 2012 targets for protected area coverage in September 2009, it was noted that 13.5% of the world's forest area is included in nationally protected areas; however, 46% of the 670 WWF terrestrial eco-regions with forest cover have less than 10% of their forest areas protected (the full report is available at www.unep-wcmc.org/protected_areas/pubs.htm).

Table 2.4 shows that, apart from Malaysia and the column on the attribution of protection areas to one of the IUCN conservation categories, there is a lack of data. This is in part because many countries consider that all permanent forest estate, including managed forest, has protected area status.

In the light of threats posed to forest ecosystems from deforestation, several countries recognise the need to protect examples of them. For example, two Commonwealth countries, Malaysia and Brunei Darussalam, have combined with Indonesia to establish, with the assistance of WWF, the Heart of Borneo Initiative (HOB). This is a network of protected areas covering an expanse of trans-boundary highlands which includes unique biological diversity – see www.wwf.or.id.

Forests continue to surprise the world with hitherto undiscovered species. An example of the discovery of a new tree species was the Wollemi pine, *Wolemia nobilis*, which was discovered in 1994 west of Sydney, Australia. There are less than 100 individuals, and the exact location of the site is still a secret. Previously the genus had been known only from fossil records. Now plants have been bred, some have been distributed to major botanic gardens and they are even available for the public to purchase – see www.wollemipine.com.

WWF has noted that the forests of Borneo (the Malaysian States of Sabah and Sarawak, and Kalimantan the Indonesian part of Borneo) contain plants which are potentially a "medical treasure trove" and 422 new plant species have been found in the last 25 years. Another example is from Papua New Guinea where in 2008 more than 40 previously unidentified species were found in the kilometre-deep crater of Mount Bosavi, a pristine habitat teeming with life that has evolved in isolation since the volcano last erupted 200,000 years ago.

A form of *ex situ* tree conservation, which may be overlooked by foresters, is the botanic garden. Botanical gardens, which in Europe developed from the monastery herb gardens for raising medicinal plants, have a long history in the Commonwealth. Several were started by foresters as arboreta and many tree species, both ornamental and economic, were introduced through them.

According to Botanic Gardens Conservation International (BGCI) there are over 1,800 botanic gardens in the world, and although several of them are devoted to plant forms other than trees, there are few which do not contain some specimen trees. BGCI has defined botanic gardens as "institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education" (www.bgci.org), and based on that definition the data in *Table 2.5* on botanic gardens in the Commonwealth has been derived.

Although much of the work of botanic gardens will continue to be scientific research and conservation, their educational and recreational purposes will become increasingly important with growing urbanisation.

Threats to SFM

There are a number of threats to the practice of SFM, of which four – fire, attack by insects and disease, invasive species and illegal logging – are considered here.

Fire

(Unless otherwise stated, the main source for this section is FAO, 2007.)

Forest fires have been, and still are, a major threat to forests throughout the world, and three Commonwealth countries, Australia, Canada and India, are particularly affected. The world's attention was caught by the fires of 1997-98 in South-east Asia and in 2002 and 2003 by severe fires near Canberra, Australia and in British Columbia, Canada. It is reported that 3.7 M ha of forest worldwide are currently affected annually by fire causing damage estimated at US$107 million. Many African countries sustain yearly fires in savanna woodland, and the impact of fires is severe on the livelihoods of rural

people in all developing countries, especially the poorest people, the disadvantaged, minorities and women. The health of the people of some Asian countries has suffered in recent years (including 2006) from the effects of smoke and haze from fires in their neighbours' forests, while developed economies spend large sums every year on suppression and (to a lesser extent) prevention. Yet despite the losses of human lives and property and damage to the environment there is a shortage of information on the problem and – possibly in consequence – a lack of public pressure or political will, once memory of the tragedy is fading, to take long-term action.

But it must be appreciated that fire is necessary for the regeneration of some naturally fire-dependent ecosystems, such as savanna woodlands or the boreal forest in Canada, and fire may be used as a tool for land management in many ecosystems. The positive and negative roles of fire must be understood by an increasingly urban population and the need for the broad management of fires, rather than just fire suppression.

People are nearly always the main cause of fires, either through carelessness or deliberate arson, but in Canada lightning is the cause of 35% of fires and 85% of the area burned, because such fires occur in remote areas. It is not easy to prevent arson; in the 2002-03 fire season Australia reported 10,000 cases of actual or potential arson, but there were only 43 convictions. And people contribute to the damage cause in other ways. Rural-urban migration in developing countries means that fewer people available to put out fires, and the problem has been made worse where HIV/AIDS has caused high mortality. Urban people have a poor appreciation of the threat posed by fires and both Canada and Australia report the poor siting of houses in high-risk locations in the Wildland Urban Interface (WUI). Furthermore, urban dwellers perceive all fires as harmful to the environment and public pressure in Australia has led to fuel accumulation – with eventually more severe fires.

Simple means of fire control are common in many countries; for example Botswana, Namibia and South Africa prepare every year an extensive network of fire breaks. Sophisticated means of fire detection and suppression have been introduced in developed economies, but at a high cost. Australia has reported that aerial support to fire suppression cost A$80 million in 2002-03, while Canada has drawn attention to recent changes in fire weather patterns leading to much greater variability in hazard and thus in suppression costs; the annual mean cost has been C$382 million but it may range up to double that figure. In fact, Canada warns that present fire suppression practices may not be sustainable due to increasing costs, with possible effects on wood supply and the competitiveness of the forest industry.

The main challenge facing Commonwealth countries in fire management is the people; their understanding of the dangers of fire and of the consequences of unintentional or intentional setting of fires, their education in the need for early burning and even in the positive

Black Saturday BOX 2.2

In February 2009 a heat wave and high winds of more than 100 km/hour led to bushfires in Victoria, Australia, which killed 173 people and destroyed or severely damaged 5,500 buildings in several towns near the state capital Melbourne, with the insurance bill topping A$1.12 billion. In the light of forecasts that the December 2009-February 2010 fire season could be particularly high risk the Government took exceptional precautions, including the preparation of "neighbourhood safe places" where people could go should fire threaten their homes. The authorities in Victoria have even proposed the electronic monitoring of known arsonists to prevent them from entering fire-prone areas.

Source: Reuters, 11 October 2009.

LEFT
A fire truck moves away from out of control flames from a bushfire in Australia's Bunyip State Forest in 2009 – fires are a major threat to forests throughout the world.

effects of fire. This has been summarised by Handmer (2003) for Australia but his words are relevant elsewhere: "Those creating the risk [of fires] historically have no direct interaction with those dealing with the results. Worse perhaps is the absence of any useful engagement with those creating the future risk [which] fire and emergency services will be dealing with in the future" [factors such as climate change, urban expansion, changes in lifestyle, etc.]. Since many fires arise from burning for clearing agricultural land other challenges are institutional, with the programmes of Agricultural Departments, or concerned with policies which promote burning.

There are great opportunities for the exchange of information and experience in fire protection and prevention, such as the development of simple early-warning systems, public education and institution building. Africa has developed a network for the exchange of information, AfriFireNet, established in 2002, while India hosted the Asia-Pacific workshop Scientific Dimensions of Forest Fires in 2000. Many countries could learn techniques for community participation in Community Based Fire Management (CBFiM) from Mozambique, Namibia, and South Africa, which have pioneered the concept, and India has given JFM committees responsibilities to protect forests from fire, with significant reductions in forest fires of up to 90% in some regions.

Insects and disease

Damage to trees and forests from insects and disease has received much less attention, either from foresters or the general public, than damage from fires – with two possible Commonwealth exceptions. The first was the almost universal elimination of mature elm trees (*Ulmus procera*) in the United Kingdom in the 1970s, from Dutch elm disease (*Ophiostoma ulmi*) spread by elm bark beetle *Scolytus scolytus* and *S. multistriatus*.

Bacterial Bleeding Canker of Horse Chestnut

BOX 2.3

Horse chestnut (*Aesculus hippocastanum*), which was introduced to the UK from Turkey 500 years ago, has become a highly popular ornamental and avenue tree with its well-shaped canopy, showy white flowers and prickly fruit containing shiny seeds popularly known as conkers. There may be between 1 and 2 million specimens nationwide.

But in recent years it has been attacked by an aggressive bacterial pathogen which is causing widespread death. The pathogen, which has been identified as *Pseudomonas syringae*, attacks the bark and cambium of the tree, causing cracks and cankers and, as the infection progresses, causing the wood to dry out, frequently leading to the fracture of branches especially where a fork has been infected. There appears at present to be no means of management or chemical treatment to reduce fatalities; all sizes are killed and neither the white- nor the red-flowered varieties escaping – although a very few individuals may show resistance, for reasons that are as yet unknown. A recently developed treatment from the Netherlands, however, based on allicin (an extract of garlic) is being tested by English Heritage, which may offer some promise, but otherwise the maintenance of tree health is the best line of defence, since healthy trees appear to withstand attack better than unhealthy individuals.

Sources: Mabbett (2008); The Garden (2009); and the website of English Heritage www.english-heritage.org.uk.

The second is more recent: the infestation of mountain pine beetle (*Dendroctonus ponderosae*) in British Columbia, which attacks all pines. The cumulative area affected by the beetle was 14.5 M ha in 2008, and from 1998 to 2008 (inclusive) it killed an estimated 620 M m^3 of pine in British Columbia or almost half of the province's commercial pine. The outbreak is still spreading – into Alberta and the USA for example – but the rate of spread may have peaked in 2004 (see www.canadaforests.nrcan.gc.ca/indicator/mountainpinebeetle).

Figures from New Zealand put the threat from pests and diseases into perspective. Forest industry in that country spends US$0.60 per ha on monitoring pest and disease outbreaks, but US$3.50 on fire protection. Yet the average yearly losses due to pests and disease is US$137 million, compared with losses of US$682,000 from fire (Hocking, 2003).

Other serious, but less-noticed disease and insect attacks have affected pines and cypress in eastern and southern Africa. The earliest, dating from the 1950s, was the fungus *Dothistroma pini*, a needle blight which affected *Pinus radiata* grown in Kenya, Tanzania and Uganda, which ultimately spread to New Zealand. They were accidentally introduced in the 1970s, illustrating the threat from invasive species that may be spread by increasing passenger and freight air traffic. They include the pine woolly aphid (*Pineus boerneri*), the pine needle aphid (*Eulachnus rileyi*) and the cypress aphid (*Cinara cupressivora*). By 1990 it was estimated that the last-named had caused damage worth US$44 million and was continuing to cause loss of increment valued at US$14.6 million yearly (FAO, 2006).

Invasive Mesquite

BOX 2.4

Prosopis juliflora (mesquite), which was introduced to Kenya and several other countries to combat desertification, has itself become a problem, invading farmland and damaging farmers' livelihoods.

Now *P. juliflora* is the target of a government control programme after research by the Kenya Forestry Research Institute (KEFRI) found that up to 27 M ha of land were at risk from the plant. The study, carried out in Turkana district in north-west Kenya, also showed that a local acacia tree, *Acacia tortilis*, is declining by over 40% in some areas possibly because *P. juliflora* is displacing it.

Meanwhile the Kenya Forest Service is training farmers on how to live with the shrub, by using its pods for fodder and stems for firewood and charcoal.

Source: Science & Development Network, 2009.

Invasive non-native species

A threat to forest integrity which has recently been recognised is posed by invasive non-native species. They are: "any species that are non-native to a particular ecosystem and whose introduction and spread causes, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health" (see www.fao.org/forestry/aliens/en/).

The unintentional introduction of such animal or plant species has been helped by the increasing movement of people and goods worldwide. In the absence of their natural controls and competitors they may thrive and spread at the expense of native species, affecting entire ecosystems. But some invasive species have been intentionally introduced into ecosystems outside their native ranges to provide economic, environmental or social benefits – the introduction of ornamental plants to gardens for example. These species have then escaped to become serious problems in forests and other ecosystems.

There is concern in the forest sector that some of the tree species used for agroforestry, commercial plantations or desertification control are alien or non-native to the area and may escape. An example of a genus that has been introduced in many dry and semi-arid countries is *Prosopis*; it provides desertification control, restores degraded lands and can be used as firewood, but in several locations it is spreading almost uncontrollably into agricultural land, or choking irrigation canals – *Box 2.4* gives an example from Kenya.

Overall, there is a lack of information on invasive species and the forest ecosystems that they affect which is hindering the development of control techniques. Two networks have been established with FAO support in order to start to rectify this: the Forest Invasive Species Network for Africa (www.fao.org/forestry/site/28240/en) and the Asia-Pacific Forest Invasive Species Network (www.fao.org/forestry/site/28241/en).

Illegal logging[4]

Illegal activities associated with the timber trade cover a very wide range, from illegal logging (for example, in breach of the contract or outside the concession area), smuggling (often across national borders and sometimes of species restricted under CITES), misclassification and corruption – either on a large scale or petty. One estimate has suggested that illegal activities may account for over one-tenth of value of the global timber trade, worth over US$150 billion yearly (Brack, 2003) while a review of the timber harvesting industry between 2000 and 2005 in Papua New Guinea found that most were not only ecologically and economically unsustainable but also illegal (Forest Trends, 2006) – however, *see Box 2.5 over*.

Illegal activities not only prevent the sustainable management of a country's forest and deprive it of revenue, but also undermine its good governance by condoning disregard for the law and the tolerance of corruption. The constraints to dealing with illegal logging include:

- Lack of national capacity for the enforcement of forest (and other) laws, and coordination;
- The ease with which timber may be moved across national borders;
- The difficulty of distinguishing between legal and illegal timber;
- The frequent absence of a legal framework in importing countries to use against timber produced illegally elsewhere.

A possible constraint is that the cost of curbing illegal logging would lead to increases in the price of

4 The special issue of *International Forestry Review* Vol. 5 (3) of September 2003 is an authoritative review of illegal logging and the illegal trade in forest and timber products. More recently, a joint meeting of the Commonwealth Forestry Association and the Royal Commonwealth Society devoted to *Trees, cash and politics: why good wood means good business* reviewed the both the international situation and the particular case of the UK. The two presentations on that occasion, by Brack and Roby, are available on the CFA website. See also www.illegal-logging.info.

Australia and Papua New Guinea Fight Illegal Logging BOX 2.5

Formal agreement was reached in June 2009 between the two countries to join forces to tackle illegal logging, including working closely together on SFM and certification; the promotion of trade, investment and sustainable development, including improvements in verifying the legal origin of timber and timber products; and identifying areas for cooperation on climate change mitigation approaches.

Source: *CFA Newsletter,* No. 46 of September 2009.

timber, but this suggests that there is an economic incentive exists for legitimate producers to support measures to reduce illegal logging (Turner *et al*., 2008).

Certification is part of, but not the complete answer to, combating illegal logging. The section on certification above has shown that probably more than 21% of the forests of the Commonwealth are already covered by certification schemes. However, they are costly for small or community-owned woodlands; even the scheme of the Forest Stewardship Council for Small and Low Intensity Managed Forest Scheme is expensive (Butterfield *et al*., 2005).

Some high-tech solutions have been introduced to curb illegal logging – for example, Cameroon has entered into partnership with the World Resources Institute's Global Forest Watch to map logging roads from satellite imagery (*CFA Newsletter,* No. 28 of March 2005). Another approach has recently become available with the mapping of the tree genome, which allows the identification of genetic differences between individual trees, even of the same species, and the mapping of these differences according to their geographic location in a database. It is hoped that this approach will help the Singapore authorities to stamp out illegal logging, by proving where wooden furniture has come from (*CFA Newsletter,* No. 46 of September 2009). But illegal logging will not be reduced without good governance and competent and motivated staff to enforce the forest laws.

Summary

There is evidence that forest management in Commonwealth countries has moved towards more sustainable practices in recent years. For example more (but not all) of the permanent forest estate is regulated by management plan than was the case 20 years ago, not only in the developed economies but in developing member countries, and more concessions are controlled by licence. Information is far from complete, and the existence of a management plan is not proof of the implementation of sustainable management, but taking into account other information discussed below it appears that management practices have improved. Bruenig (2006), in discussing the ITTO studies which form the basis of *Tables 2.1* and *2.2*, noted that "a much greater input of funds, qualified personnel, methodology… is necessary to procure an accurate, reliable and sufficient data base for the state and role of SFM in the tropical forests and forestry economy .

Forty-one Commonwealth countries are members of one or other of eight Criteria and Indicator Processes, the exceptions being some Caribbean countries. Several have placed at least some forest area under one of the certification schemes, and four have developed their own schemes; the UK government and several large UK timber retailers use certified timber exclusively. About 21% of the forest area of the Commonwealth is certified.

The global trend towards participatory processes has been reflected in forest management in several Commonwealth countries. Three initiatives: Joint Forest Management, the Iwokrama International Centre for Rain Forest Conservation and Development and the International Model Forest Network have participation at the heart of their programmes and Iwokrama and the IMFN are disseminating their experience of sustainable forest

conservation and use to other countries. A more recent concept, Forest Landscape Restoration considers forest management and restoration within the broader landscape rather than solely the tree cover at a particular location; the partners in FLR are also disseminating this message.

But these developments in forest management are concerned with temperate and tropical/sub-tropical moist forest types. Apart from the Dry-zone Africa and the Dry Forest in Asia Processes there appears to be little development of forest management techniques for savannah woodlands.

Planted forests will be a component of all forms of forest management in all zones. Large-scale plantations will continue to be established by industry, but there will be increasing emphasis on planted forests established by smallholders (*see Chapter 1*), often to produce raw material for industry. Government policies and incentives will have a crucial role to play in encouraging this (*see Chapter 4*), but investors' perceptions of economic and political stability will determine where plantation programmes are established.

There is much less information on the conservation of forests, partly because of difficulties in defining forest conservation areas and distinguishing them from the permanent forest estate. There are, however, examples of countries establishing forest conservation areas and of acting in partnership to establish cross-boundary protected areas. There are many botanic gardens in Commonwealth countries, which are a form of *ex situ* conservation.

The sustainable management of forests in the Commonwealth has been constrained by a number of institutional factors, including shortages of funds and capacity. The development of effective forestry institutions and good governance at the national level will also be essential in combating the other major threat to sustainable management of illegal logging. Illegal activities largely occur in developing countries, but combating them will involve not only the country of origin but also the developed countries of destination. International action is now being taken, but whether it will be sufficient remains to be seen. Neither does certification appear to be the complete answer.

A major factor affecting the implementation of sustainable forest management is climate change, which is already causing changes which lead to increased outbreaks of insect and diseases as well as fires, but also may lead to the spread of invasive species.

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Trinidad and Tobago

Over 100 Years of Forest Management

The foundation for the establishment of Forestry Division of Trinidad and Tobago was laid in **1901** with the formation of a one-man branch of the then Crown Lands Department. However, concern over forest resources could be traced even earlier to the eighteenth century, as in **1765**, the first, and probably the oldest, forest reserve in the Western Hemisphere – the Main Ridge of Tobago – was created by the Young Commission through the allocation of 2,475 hectares of land for "the protection of the rains". This area is now managed by the Department of Natural Resources and the Environment, Tobago House of Assembly and is internationally acclaimed as a first-rate ecotourism site.

Further progress was realized in **1918**, when the one-man Branch was upgraded to the Forest Department and separated from the Crown Lands Department. In **1960**, the Forestry Department became the Forestry Division.

In the early years, the emphasis was on the survey and demarcation of forest reserves. This was then followed by the establishment of commercial timber plantations; primarily teak and pine. Teak was introduced in **1913**, followed by Caribbean Pine in **1946**. In **1932**, the Tropical Shelterwood System was introduced to regenerate the natural forest at the Arena Forest Reserve.

While forest management initiatives must by nature adopt a long-term perspective, forestry institutions must be able to respond promptly to local, national and international concerns. The Forestry Division's initiatives guided by a formal Forest Policy formulated in **1942**, strive to illustrate this dynamism, through the introduction and expansion of several key programmes.

In **1972**, the Northern Range Reafforestation Project was initiated to address widespread watershed degradation occurring in the Northern Range and consequent flooding of low-lying areas.

In **1977**, work was initiated to develop a system of National Parks and Protected Areas for sustainable management of these resources for recreational, historical, scientific and conservation purposes.

In **1997**, a programme to assist private land owners to grow and maintain forest trees on their holdings was started. This not only enhanced the landowners' assets but also assisted in rehabilitating watersheds and generating income in rural areas.

Within the last five years, major effort has gone into the development of a Strategic Plan for the Division and for the revision of the Forest Policy and formulation of a Protected Areas Policy. The Division has also begun work on a national forest inventory including the production of an updated forest cover map.

The current work programme of the Forestry Division encompasses three broad technical components, *viz*, forest management, parks and recreation and wildlife management. Work also extends to wetland restoration at Nariva Swamp, a project which is attracting international attention, for *inter alia* its carbon sequestration potential in combating global warming.

Like similar institutions in other countries, the Forestry Division of Trinidad and Tobago is making a determined effort to remain relevant to current concerns, especially looming environmental crises. Even so, challenges of outdated legislation and inadequate institutional arrangements must be confronted.

Forestry Division
Trinidad and Tobago