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Towards a Global Tree Conservation atlas

Mapping the status and distribution of the world's threatened tree species

Adrian Newton, Sara Oldfield, Gerardo Fragoso,
Paul Mathew, Lera Miles, Mary Edwards

UNEP

UNEP World Conservation Monitoring Centre
219 Huntingdon Road
Cambridge CB3 0DL
United Kingdom
Tel: +44 (0) 1223 277314
Fax: +44 (0) 1223 277136
E-mail: info@unep-wcmc.org
Website: www.unep-wcmc.org

Director: Mark Collins

THE UNEP WORLD CONSERVATION MONITORING CENTRE is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organization. UNEP-WCMC aims to help decision-makers recognize the value of biodiversity to people everywhere, and to apply this knowledge to all that they do. The Centre's challenge is to transform complex data into policy-relevant information, to build tools and systems for analysis and integration, and to support the needs of nations and the international community as they engage in joint programmes of action.

Fauna & Flora International
Great Eastern House
Tenison Road
Cambridge CB1 2TT
United Kingdom
Tel: +44 (0) 1223 571000
Fax: +44 (0) 1223 461481
E-mail: info@fauna-flora.org
Website: www.fauna-flora.org

Director: Mark Rose

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Contributors

Adrian Newton, Lera Miles, Gerardo Fragoso, Mary Edwards
UNEP World Conservation Monitoring Centre (UNEP-WCMC)
219 Huntingdon Road, Cambridge CB3 0DL, UK
Tel: +44 (0) 1223 277314 Fax: +44 (0) 1223 277136
E-mail: info@unep-wcmc.org

Sara Oldfield, Paul Mathew
Fauna & Flora International (FFI)
Great Eastern House, Tenison Road, Cambridge CB1 2TT, UK
Tel: +44 (0) 1223 571000 Fax: +44 (0) 1223 461481
E-mail: sara.oldfield@fauna-flora.org

Aljos Farjon, Royal Botanic Gardens, Kew and Chair of the IUCN/SSC Conifer Specialist Group, supplied geographical data on conifers used to build the map on page 9.

Cristian Echeverria, UNEP-WCMC, assisted with the development of a series of conifer species maps whilst a Global Trees Campaign bursary scholar supported by the International Dendrology Society. He also helped prepare information for the species profiles, particularly that for *Araucaria araucana*.

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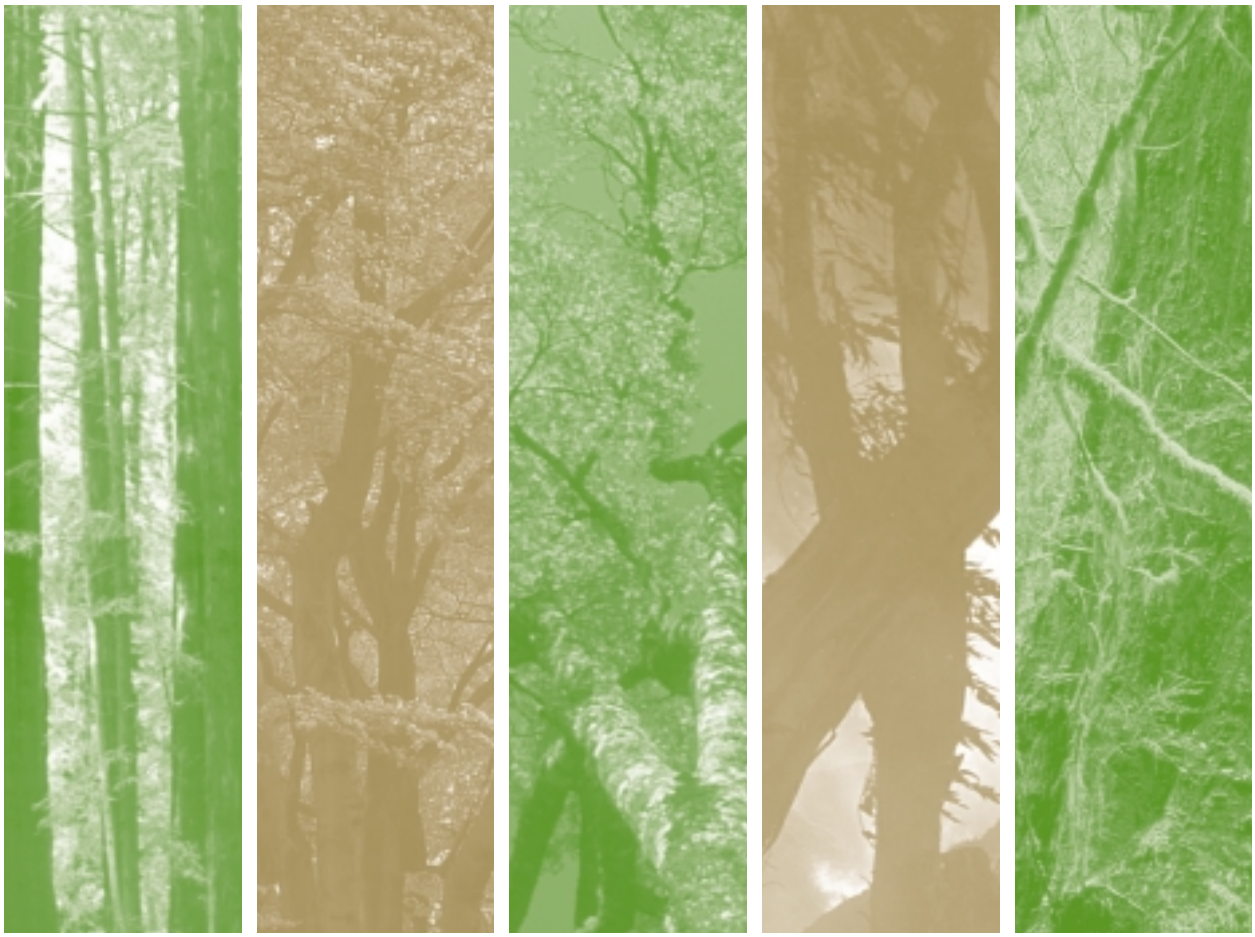

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Contents

Foreword

It is widely recognized that forests are the most biologically diverse terrestrial ecosystems and that pressures on forest biodiversity continue to increase throughout the world. Around 350 million of the world's poorest people depend almost entirely on forests for their basic needs and 2 billion people depend on wood for cooking and fuel. The Plan of Implementation of the World Summit on Sustainable Development (WSSD) notes that:

> *Forests and trees cover nearly one third of the Earth's surface. Sustainable forest management of both natural and planted forests and for timber and non-timber products is essential to achieving sustainable development and is a critical means to:*
> - *eradicate poverty;*
> - *significantly reduce deforestation;*
> - *halt the loss of forest biodiversity;*
> - *halt land and resource degradation;*
> - *improve food security and access to safe drinking water and affordable energy.*
>
> *Achievement of sustainable forest management, nationally and globally, including through partnerships among interested governments and stakeholders, including the private sector, indigenous and local communities and non-governmental organizations, is an essential goal of sustainable development.*

UNEP-WCMC and FFI are working together to support the conservation of trees and forests around the world through the Global Trees Campaign. The Campaign is taking action to halt the loss of forest biodiversity and to support rural livelihoods, both essential components of sustainable development as recognized at WSSD. We work with a wide range of partners to develop and implement tree species and habitat conservation programmes. We also provide decision-making support tools and information to assist policy development and implementation relating to sustainable forest management.

We believe that the development of map-based information products for tree species will strongly support the implementation of international agreements and conventions, notably the Convention on Biological Diversity (CBD) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), at national, regional and international levels. Development of a *Global Tree Conservation Atlas* will highlight the value of tree species to human society and will directly support action to prevent tree species extinctions.

We believe that the *Global Tree Conservation Atlas* will be of outstanding value in supporting future efforts aimed at the conservation and sustainable use of tree species. We commend it strongly to you for support.

Mark Collins
Director
UNEP World Conservation Monitoring Centre

Mark Rose
Director
Fauna & Flora International

Introduction

Tree species are important for the well-being of people in all countries, particularly in the humid tropics and arid landscapes around the world. Many tree species are of major economic importance as the source of products such as timber, fruits, nuts, resins and gums. Worldwide, 2 billion people depend on wood for cooking and fuel; millions of others depend on trees for food and medicines. Trees are also the structural components of forests, providing a habitat for many other species and defining the characteristics of forest ecosystems.

Information is limited on the distribution and conservation status of tree species. Preliminary surveys undertaken to date suggest that approximately 8,000 tree species are threatened with extinction worldwide. The potential loss of nearly 10 per cent of all tree species is a major conservation issue, requiring international attention and widespread action.

The Global Trees Campaign is a joint initiative developed by UNEP-WCMC and FFI in partnership with a wide range of other organizations around the world. The aim of the Campaign is to save the world's most threatened tree species and the habitats in which they grow through the provision of information, delivery of conservation action and support for sustainable use.

Reliable and up-to-date information is essential to underpin the aims of the Global Trees Campaign. Initial information to support the Campaign was derived from the results of the global conservation status survey of tree species undertaken by WCMC (now UNEP-WCMC) in association with the Species Survival Commission (SSC) of IUCN-The World Conservation Union and additional experts around the world. The WCMC/SSC survey identified more than 8,000 tree species which are threatened with extinction at a global level, published in *The World List of Threatened Trees* (Oldfield *et al.*, 1998). Summary information on these species is available on the Internet via the Tree Conservation Information Service now connected to the Global Trees Campaign website (www.globaltrees.org).

Data on the distribution of tree species was critical to assessing their conservation status in the WCMC/SSC survey. The majority of threatened trees were evaluated as such on the basis of being confined to a limited area or habitat which is fragmented and declining in quality or extent. In the absence of population or autecological data for most tree species, spatial data linked to habitat type and trends in patterns of land use remain an important indication of threat status. This is particularly true for the 80 per cent of tree species that are found in the tropics.

Information about tree species reinforces the information needed to conserve habitats and ecosystems. Various initiatives (SBSTTA, 1996; Lammerts van Bueren and Duivenvoorden, 1996) have suggested that tree species diversity can be used as a surrogate for overall species diversity in forest ecosystems. Information on the distribution of restricted range species can be used to determine patterns of biodiversity and define priority areas for conservation. Tree species information also provides a crucial link with information on patterns of genetic resources within forest ecosystems.

This summary document outlines the need for spatial data on tree species as a tool for conservation action. It introduces plans for a tree species mapping programme that will build on the forest mapping information management expertise of UNEP-WCMC. A *Global Tree Conservation Atlas* will be produced as an output of the mapping programme and will be one of the main information outputs of the Global Trees Campaign. The mapping programme will provide:

- maps of threatened tree species as a tool for conservation and management planning;
- spatial analysis of tree species diversity to define priority areas for conservation;
- profiles of threatened tree species, for raising awareness, providing educational tools and strengthening the impact of conservation messages;
- improving the information used to assess the risk of extinction to tree species;
- support for policy development and implementation, for example by providing information on species subject to international trade or those included in action plans.

POLICY CONTEXT

The objective of international biodiversity and forestry policy is to prevent the loss of ecosystem functioning, component species and genetic resources whilst at the same time supporting the rights and development aspirations of people. One of the challenges facing the implementation of international policy is to make the best use of scattered and diverse information. Recent policy initiatives relevant to the conservation of tree species are summarized below, with particular reference to the World Summit on Sustainable Development (WSSD).

United Nations Forum on Forests (UNFF): the UNFF was established in 2000 to promote the management,

Box 1 **Objectives and activities of the CBD Workplan for Forest Biodiversity supported by conservation assessments of tree species**

Objective: Promote forest management practices that further the conservation of endemic and threatened species.

Activities

Determine status and conservation needs of endemic or threatened species and the impacts of current forest management practices on them.

Develop and implement conservation strategies for endemic and threatened species for global or regional application, and practical systems of adaptive management at national level.

Objective: Ensure adequate and effective protected forest area networks.

Activities

Assess the efficacy of protected forest areas for the conservation of biodiversity.

Objective: Promote sustainable use of forest resources to enhance the conservation of biodiversity.

Activities

Develop initiatives that address the sustainable use of timber and non-timber forest products.

Implementation of voluntary third-party forest certification schemes that take into account biodiversity criteria.

Objective: Prevent losses caused by unsustainable harvesting of timber and non-timber forest resources.

Activities

Assist importing countries to prevent the entry of unsustainably harvested forest resources which are not covered by CITES.

Objective: Develop effective and equitable information systems and strategies for *in situ* and *ex situ* conservation and sustainable use of forest genetic diversity, and support countries in their implementation and monitoring.

Activities

Develop, harmonize and assess the diversity of forest genetic resources, taking into account key functional/keystone species and populations.

Develop national conservation action plans for the most threatened forest ecosystems based on genetic diversity of priority species and populations.

Improve understanding of patterns of genetic diversity and its conservation in situ.

Develop a holistic framework for the conservation and management of forest genetic resources at national, sub-regional and global levels.

Implement activities to ensure adequate and representative in situ *conservation of the genetic diversity of endangered, overexploited and narrow endemic forest species.*

Objective: Increase public support and understanding of the value of forest biological diversity and its goods and services.

Activities

Increase public awareness of the value of forest biodiversity through international, national and local campaigns.

Promote consumer awareness about sustainably produced forest products.

Develop awareness of the impact of production and consumption patterns on loss of forest biodiversity.

Objective: Develop national forest classification systems and maps.

Activities

Develop and apply national forest ecosystem classification systems and maps that include key components of forest biodiversity.

Use adapted technology, for example GIS, to develop a baseline for assessing levels of deforestation and impacts on biodiversity.

Objective: Develop specific forest ecosystem surveys in priority areas for conservation and sustainable use of forest biodiversity.

Activities

Identify and prioritize areas to carry out surveys.

Objective: Advance the development and implementation of international, regional and national criteria and indicators for sustainable forest management.

Objective: Conduct key research programmes on the role of forest biodiversity and ecosystem functioning.

Activities

Research to improve understanding of the relationship between biodiversity and ecosystem functioning, taking into account ecosystem components.

Research on critical thresholds of forest biological diversity loss and change, with particular attention to endemic and threatened species and habitats.

Develop and apply restoration techniques.

Research on impact of forest management practices for forest biodiversity within forests and on adjacent land.

CBD Decision VI / 22

conservation and sustainable development of all types of forests and to strengthen long-term political commitment to this end. The UNFF is responsible for taking forward the work of the Intergovernmental Panel on Forests (IPF)/ Intergovernmental Forum on Forests (IFF). The WSSD Plan of Implementation called for an accelerated implementation of the IPF/IFF proposals for action by countries and by the Collaborative Partnership on Forests. It also called for intensified efforts on reporting to contribute to a UNFF assessment of progress in 2005. The IPF/IFF proposals for action, among other issues, indicate the need to:

- prepare information on the management, conservation and sustainable development of all types of forests;
- expand and improve the quality of forest assessments;
- promote research and analysis and address gaps in current knowledge;
- make forest-related information available to policy-makers and interested groups;
- develop and implement appropriate strategies for protection of the full range of forest values.

Convention on Biological Diversity (CBD): the WSSD Plan of Implementation considers that the CBD is the key instrument for the conservation and sustainable use of biological diversity and the fair and equitable sharing of benefits arising from the use of genetic resources. The Plan of Implementation reinforces the implementation of the CBD Workplan for Forest Diversity agreed at the sixth Conference of the Parties (COP6) to CBD. Elements of the Workplan that are supported by improving information about the conservation status of tree species are highlighted in Box 1 (page 5).

The Global Strategy for Plant Conservation (GSPC) was agreed by the Parties to CBD in April 2002. The ambitious Strategy has 16 targets for delivery by 2010. Implementation of activities to meet key targets will be dependent on baseline information. Assessments of the conservation status and distribution of tree species will be particularly valuable to support Targets 2, 5, 6, 7, 11 and 14 as shown in Box 2 (below).

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES): the main objective of CITES is to protect species of wild fauna and flora from

Box 2 The value of tree species assessments in implementation of the CBD Global Strategy for Plant Conservation (Targets to be reached by 2010)

Target No. 2

Preliminary assessment of the conservation status of all known plant species at national, regional and international levels.

Value of tree species assessments: Assessment of tree species will be a key component of this target. A proposed milestone is the reassessment of all species in *The World List of Threatened Trees* by 2006.

Target No.5

Protection of 50 per cent of the most important areas for plant diversity assured.

Value of tree species assessments: Presence of globally threatened species is one of the three criteria for selection of Important Plant Areas, therefore species assessment is important as an aid to site selection.

Target No. 6

At least 30 per cent of production lands managed consistent with the conservation of plant diversity.

Value of tree species assessments: Spatial data on trees is particularly important for resource management in areas of production forest.

Target No. 7

60 per cent of the world's threatened species conserved *in situ.*

Value of tree species assessments: Important for protected area planning to ensure adequate representation of threatened tree species.

Target No. 11

No species of wild plant endangered by international trade.

Value of tree species assessments: An estimated 1,000 globally threatened trees are threatened at least in part by unsustainable levels of felling for international trade. Information is required for the selection and management of species for international trade control mechanisms such as CITES.

Target No. 14

The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes.

Value of tree species assessments: The concept of developing illustrated profiles of tree species, supported by maps, will have high educational value.

Box 3 **Spatial components in the biological criteria for CITES Appendix I listing**

Criterion A
The wild population is small, and is characterized by at least one of the following (5 sub-criteria):

- an observed, inferred or projected decline in the number of individuals or the area and quality of habitat;
- each sub-population being very small.

Criterion B
The wild population has a restricted area of distribution and is characterized by at least one of the following (4 subcriteria):

- fragmentation or occurrence at very few locations;
- an observed, inferred or projected decrease in any of the following (5 qualifiers): the area of distribution; or the number of sub-populations; the area or quality of habitat.

Criterion C
A decline in the number of individuals in the wild, which has been either (2 subcriteria):

- inferred or projected on the basis of any one of the following (4 qualifiers): a decrease in area or quality of habitat.

Numerical guidelines are set for the areas of distribution in these three criteria.

overexploitation through international trade by means of international cooperation. Species that are covered by the provisions of the Convention are included in appendices. To qualify for Appendix I, taxa must be "threatened by extinction" and "are or may be threatened by trade". Species included in Appendix II are those which, "although not necessarily now threatened with extinction, may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival".

At present the provisions of CITES apply to some 20 tree species traded at least in part for timber products. There have been calls to use CITES more extensively for timber species. The final report of CITES Timber Working Group (TWG) endorsed by the CITES COP10 in 1997 noted that "many internationally traded timber species, boreal, temperate and tropical, can be managed on a sustainable basis through the application of appropriate silvicultural techniques, but that for other timber species such knowledge is currently lacking; and that there may be timber species which are under threat because of detrimental levels of use and international trade".

Consequently the TWG recommended that "the range states should pay particular attention to internationally traded timber species within their territories for which knowledge of biological status and silvicultural requirements indicates concern".

Currently the CITES Plants Committee has been charged with developing listing proposals for additional timber species based on the *Contribution to an evaluation of tree species using the new CITES Listing Criteria* (World Conservation Monitoring Centre, 1998). Spatial data on tree species will be particularly valuable in guiding this process. The CITES Listing Criteria, which are currently subject to review, include a spatial component in the biological criteria for Appendix I as shown in Box 3 (above).

Spatial information is also important for implementing the provisions of CITES for listed species. The requirement to make non-detriment findings for the export of Appendix II species requires basic information such as geographical distribution and available habitats. As noted by Rosser and Haywood (2002): "The pattern of distribution of a species provides some indication of a species' sensitivity to harvest. Widespread species with a continuous distribution at the national or regional level are likely to be less sensitive to harvest or other threatening factors than species with a widespread but fragmented distribution. ...Species that are localized nationally, i.e. only occur in a few locations at the national level could be particularly at risk from unmanaged harvest."

The Significant Trade Review process is an important tool within CITES implementation. Geographical data on the reviewed species constitute one of the required elements in the review process.

CRITERIA AND INDICATORS FOR SUSTAINABLE FOREST MANAGEMENT

The statement of Forest Principles and Chapter 11 of Agenda 21, agreed at the United Nations Conference on Environment and Development (the Earth Summit) in 1992, called for the identification of criteria and indicators (C&I) for evaluating progress in national efforts to practice sustainable forest management. As a result, a large number of national, regional and international initiatives have been developed, including the International Tropical Timber Organization (ITTO), the Pan-European (or Helsinki) Process, the Montreal Process and the Dry Zone Asia and Dry Zone Africa processes, which have each generated sets of C&I. Currently,

around 150 countries are participating in these processes. The importance of these initiatives has been further emphasized by UNFF; many of the IPF/IFF proposals for action refer directly to engagement in C&I processes as a key step towards sustainable forest management. Indicators are also often used to assess the sustainability of forest management as a basis for certification (for example, by the Forest Stewardship Council, www.fscoax.org).

While the different processes share similar objectives and overall approach, they differ in specific content. However, a common feature of many of the C&I sets that have been developed is the importance accorded to threatened species. For example, the Montreal Process includes the following indicators:

- the number of forest-dependent species;
- the status (threatened, rare, vulnerable, endangered or extinct) of forest-dependent species at risk of not maintaining viable breeding populations;
- the number of forest-dependent species that occupy a small portion of their former range;
- population levels of representative species from diverse habitats monitored across their range.

The proposed *Global Tree Conservation Atlas* will therefore directly support sustainable forest management by increasing information about the status and distribution of tree species.

IDENTIFYING PRIORITIES FOR CONSERVATION ACTION

International and national policy initiatives provide the context for identifying appropriate conservation action, which ultimately must be implemented at the local level in order to succeed. Measures that may be taken to conserve tree species include:

- reducing the causes of decline, such as unsustainable harvesting, invasive species, fire, etc., for example by changing patterns of land use;
- introducing protective legislation for specific tree species;
- achieving *in situ* conservation, for example through the establishment of protected areas;
- achieving *ex situ* conservation through botanic gardens, arboreta and seed banks;
- undertaking ecological restoration of degraded populations.

In general, *in situ* mechanisms are the preferred way to conserve tree species, either within designated conservation areas or through sustainable use initiatives in the wider environment.

As resources for conservation are often limiting, there will be a need to define priorities so that conservation action can be targeted where it is needed most. For example, it may be necessary to identify where new protected areas should be established.

Conservation priorities can be defined in terms of species or areas.

Priority species for conservation are generally those most threatened with extinction, because they are declining rapidly, are restricted to small areas (endemics) or have few remaining individuals. Lists of threatened species may be defined at the international scale, for example on the *IUCN Red List*, or according to national priorities. Other species that might be accorded high priority for conservation include those of particularly high economic or cultural value, or those listed under international agreements such as CITES. Trees may also be afforded protection at the local scale because of their spiritual or historical significance, their role as local landmarks or their value as a habitat for other organisms.

Priority areas for conservation are often defined on the basis of species present. Typically, an area might be designated for protection if populations of threatened or endemic species occur there. Areas with a relatively large number of species or at relatively high risk of environmental change may also be considered to be a high priority for conservation. Alternatively, a protected area might be created to protect a particular forest community or ecosystem type that is rare or threatened elsewhere. However, protected areas such as national parks are often established on sites renowned for their scenic or touristic value, rather than their importance for species conservation. As a result, many populations of threatened species remain unprotected, being situated outside protected areas. In production forests, harvesting may be excluded from some areas for conservation purposes; other forest areas may be conserved for protection functions, for example the maintenance of catchment forests to sustain water supplies. Many populations of trees may be maintained in community woodlots or on farms because of their importance to local livelihoods or their particular cultural significance. The selection of conservation areas therefore depends, as with species, on their particular value to different groups of people.

The integration of different values, relevant to different scales, remains one of the greatest challenges to tree conservation. Whether or not a species is threatened with extinction at the global scale is often not appreciated at local or even national scales. Information on the status and distribution of tree species is therefore needed across a range of scales. Ultimately, conservation action at the local scale should be informed by information about the species collected throughout its distributional range.

Priority areas

A number of different approaches are currently being used at the global scale to define priority areas for conservation. These include:

- Hotspots, a concept developed by Conservation International, which are regions with a large number of endemic species that have been significantly impacted and altered by human activities;
- Centres of Plant Diversity, defined by WWF/IUCN as sites with high species richness and endemism, focusing explicitly on plants;
- Endemic Bird Areas (EBAs), defined by BirdLife International as areas where the ranges of two or more restricted-range species of bird overlap;
- Important Bird Areas (IBAs), defined by Birdlife International as areas with one or more globally threatened species, species with a restricted distribution or with exceptionally large numbers of migratory or congregatory species;
- Important Plant Areas (IPAs), defined by Plantlife International as natural or semi-natural sites exhibiting exceptional botanical richness and/or supporting an outstanding assemblage of rare, threatened and/or endemic plant species and/or vegetation of high botanic value;
- Ecoregions, a concept developed by WWF, defined as relatively large units of land or water that contain a distinct assemblage of natural communities sharing a large majority of species, dynamics, and environmental conditions.

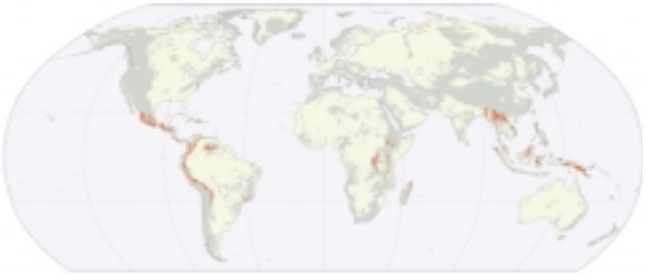
Although none of these prioritization methods focuses explicitly on tree species, many of the areas defined by these methods are also important for conservation of trees. Centres of Plant Diversity and Hotspots are of particular relevance to tree conservation, as they include many forest areas with a high diversity of tree species. IPAs as they are identified will also have particular relevance.

Few attempts have been made to date to identify those areas particularly important for tree conservation. The main approach that has been developed focuses explicitly on conifers, and was based on the presence of relatively high numbers of threatened or endemic species (Farjon and Page, 1999). Interestingly, the areas identified display a number of differences to other approaches aimed at defining priority areas for conservation. For example, many areas important for conifers occur around the Pacific rim (see map below left). Many conifers are restricted to areas that are not necessarily rich in diversity of other species. For this reason, there may be a need to explicitly define important areas for tree conservation in a similar way to the approach developed for birds. Such an approach would require the identification of appropriate criteria for area selection, which should be internationally agreed, standardized, quantitative and scientifically defensible. The collation of information on the status and distribution of tree species, as proposed for the *Global Tree Conservation Atlas*, would be of enormous value to such efforts.

Some forest types are already known to harbour relatively large numbers of threatened or endemic tree species. For example, many tree species are restricted to tropical montane cloud forests, a forest ecosystem that occurs only on the humid upper slopes of certain tropical mountains (see map below right). Cloud forests are under increasing pressure from human activities such as clearance for agriculture and logging for timber as well as the effects of climate change. Other forest types of particular importance for tree conservation include lowland tropical rainforests, tropical dry forests and temperate rainforests.

Conifer hotspots
Taken from Farjon and Page, 1999

Potential distribution of cloud forest
Tropical (and subtropical) moist mountain forests between 1,000 and 3,500 m



Priority tree species

In the following pages, we present profiles of selected tree species to illustrate the kind of information that is required to support policy development and conservation action. Such profiles will form a major part of the proposed *Global Tree Conservation Atlas*.

To prepare such profiles, information is required on the status and distribution of threatened tree species. In order to properly assess whether or not a species is threatened with extinction, information is required not only on the distributional range of the species but also the pattern of abundance across that range and the change in abundance over time.

Surprisingly little is known about the status and distribution of most tree species. Even for an economically important species such as mahogany, information is lacking on its precise distribution, the size of remaining populations and the numbers that are currently being harvested to support the timber trade. For many species of less economic importance, the available information is even more scant. This leads to great uncertainty about the conservation status of most of the world's tree species, which can only be redressed by greater emphasis on field surveys and ecological monitoring supported by taxonomic research. Information is also lacking on the main factors causing declines in the abundance of tree species and how these factors affect the viability of remaining populations. As many trees are very long-lived, it is often difficult to assess how rapidly a species is likely to become extinct. Computer modelling approaches supported by detailed field and laboratory research are required for a precise analysis of extinction risk.

A great deal of relevant information does exist, though much of it remains inaccessible to decision-makers because it resides only in the scientific literature or even in unpublished reports or observations. Collating the information and making it available to a wide audience is one of the key objectives of the Global Trees Campaign.

Apart from distribution maps and assessments of conservation status, other information can usefully form part of species profiles. Knowledge of the different uses of a particular tree can give insights into social, cultural and economic values; details of its ecological behaviour are critically important for defining appropriate approaches to conservation management. Collection of such information requires a great deal of effort, involving not only a systematic review of the scientific literature but collaboration with scientific specialists throughout the world. The information also needs to be disseminated to those who need it, either in the form of publications or over the

Internet. The management and dissemination of information relevant to conservation is one of the central activities of UNEP-WCMC. It is intended that information gathered for the production of the *Global Tree Conservation Atlas* will be made freely available over the Internet, for example through the on-line Tree Conservation Information Service (www.unep-wcmc.org/trees/GTC/gtc_front.htm).

The species included in the following profiles have been selected to illustrate different intrinsic values. They have also been selected to demonstrate the links between species and habitat prioritization processes for biodiversity conservation and the links between species data and international conventions. For example, one species, *Cinnamomum cebuense*, a local endemic flagship species within a global biodiversity hotspot, has not yet been evaluated using the *IUCN Red List* categories and criteria; the use of distribution data to assess conservation status is demonstrated. Two other species, *Araucaria araucana* and *Swietenia macrophylla,* are included in the Appendices of CITES. *Baillonella toxisperma* and *Caesalpinia echinata* are potential candidates for CITES listing. In the case of *B. toxisperma,* the profile illustrates the use of spatial data in relation to the application of the CITES listing criteria.

The maps themselves have been compiled using the best available data, combining the original type distributions and the extent of current published knowledge as given in the text. These distributions have been overlaid on a forest cover level of 40 per cent[1] to give a more representative idea of the actual area of suitable habitat that exists.

1. A 40 per cent level of canopy cover corresponds to FAO's definition of closed forest as "Formations where trees in the various storeys and the undergrowth cover a high proportion (> 40 per cent) of the ground" (FAO, 2001). It also follows definitions given in UNESCO (1973). All the species outlined in the profiles here are considered to be closed forest species.

Species profile: *Araucaria araucana*

Common Name: monkey puzzle, araucaria, Pehuén, pino araucana, pino chileno, piñonero

Scientific Name: *Araucaria araucana*

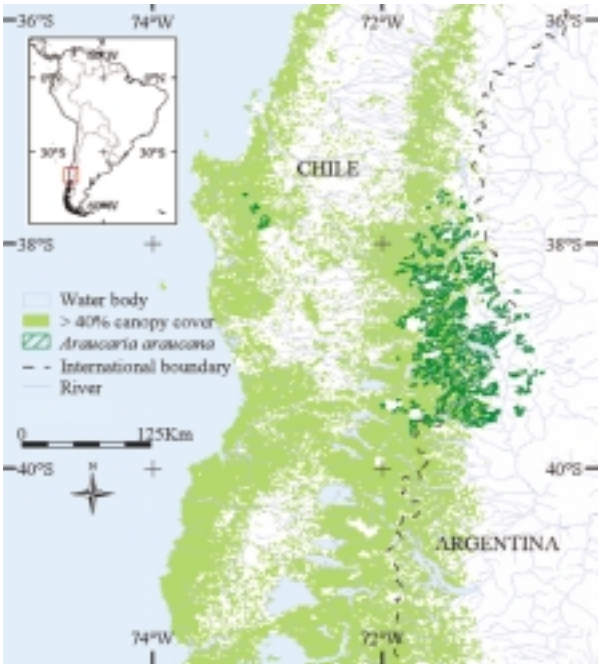
Conservation Status: Vulnerable (VU B1+2c)

A. araucana is an evergreen conifer endemic to the temperate rainforests of Argentina and Chile; in the latter it is the national tree. Although widely cultivated as an ornamental it is threatened in the wild by logging and fire.

The monkey puzzle grows in mixed evergreen or deciduous forests or in pure stands. The tree itself reaches up to 50 m in height and can be 2 m in diameter. Due to its size, straight trunk, high mechanical and moderate fungal resistance, this species has been used widely for timber. The large seeds (4 to 5 cm by 1.5 cm) are also eaten by the indigenous Pehuenche (Pehuenche meaning people of Pehuén, the local name for *A. araucana*).

Monkey puzzles can live for over 1,000 years, making the species useful for reconstructing climatic conditions throughout both its wild and artificial distribution by measuring the growth rings. In their natural habitat, monkey puzzle forests are exposed to a disturbance regime characterized by recurrent volcanic eruptions and fire. Natural fires started by lava, ejected incandescent material and lightning are common in the area. Fires were also started by the aboriginal population prior to c. 1900, and later by European settlers and other groups, often associated with logging and seed collection activities. Fire is one of the main causes of current forest loss and degradation, along with logging and grazing.

Although the species is now classified as a Natural Monument in Chile, is officially protected in Argentina and is listed on Appendix I of CITES, there is still pressure from some land uses. During 2001-02 thousands of hectares of native *Araucaria* forests were burnt in southern Chile. Preliminary information indicated that over 8,300 ha of native forest were burnt in the Malleco National Reserve, destroying 71 per cent of the *Araucaria* forests, while in Conguillio National Park 1,600 ha of pure *A. araucana* forests were lost.



In Chile, national parks and reserves that protect the species are concentrated in the Andean ranges. In the Cordillera de Nahuelbuta (Chilean Coastal Range) most of the monkey puzzle forests are privately owned. Burning, grazing and conversion to *Pinus radiata* plantations have disturbed important areas in the Coastal Range, and these threats remain ongoing. New research has found that these coastal populations have genetic differences from those of the Andes, so their conservation is of great importance.

WHAT CONSERVATION ACTION IS NEEDED?

A conservation strategy for the species should consider both protection and restoration. Protection might include the Nahuelbuta National Park and the development of new protected areas in the Coastal Range, especially in the southernmost populations; while restoration would be necessary for Andean and Coastal populations. Identification of all populations combined with the education of local landowners and communities in conservation and propagation techniques is needed.

The Global Trees Campaign is supporting conservation work by students from the Universidad Austral de Chile which includes regeneration and education programmes.

DISTRIBUTION

A. araucana grows in the Andean Range (37°S-40°S) and the Cordillera de Nahuelbuta Coastal Range (37°S-38°S) of Chile and on the eastern slopes of the Argentinean Andes (38°S-39°S). Mapped data has been taken from work by the Universidad Austral de Chile, Valdivia.

Species profile: *Swietenia macrophylla*

Common Name: Brazilian mahogany, large-leaved mahogany, Honduras mahogany, acajou, mahogani grands feuilles, caoba, mara, mógno

Scientific Name: *Swietenia macrophylla*

Conservation Status: Vulnerable (VU A1cd +2cd)

S. macrophylla is a large deciduous canopy emergent, found throughout both wet and dry tropical forest in a patchy distribution from Mexico through central Brazil to Bolivia. It has been widely harvested for its prized timber so that in many instances fully mature trees are rare.

It can reach heights in excess of 60 m, but due to logging is generally not found more than half this height, with a diameter of around 1.5 m.

Regeneration of the species is stochastic, depending on large-scale disturbance. This results in a higher density in areas subject to gap opportunities such as hurricane damage or fire. The winged seeds are distributed by wind and require light to germinate. This ecological strategy makes mahogany vulnerable to logging regimes as both disturbance and the presence of mature seed trees are required.

It is the most commercially important of the mahoganies, although large-scale trade only arose in the 1850s due to the severe decline of the preferred species, *S. mahagoni*. There is at present little economic incentive to manage natural stands sustainably and plantations have been unsuccessful due to the length of time required for management and because of attack from pests, especially shoot-borer.

Having been on CITES Appendix III since 1995, a joint proposal from Nicaragua and Guatemala to include *S. macrophylla* on Appendix II was adopted in 2002, but implementation of the listing is deferred for one year to allow range states sufficient time to adjust to the more stringent regulatory requirements. To allow for naturalized plantings elsewhere, the listing only includes neotropical populations (and specifically logs, sawnwood, veneer sheets and plywood). The species is also protected by many national laws and found widely in national parks, although there is considerable illegal logging across its range.

As well as the reduction of the population as a whole, there is also the threat of genetic deterioration due to overharvesting. Selective logging removes the best genotypes for high-quality timber and may also reduce the potential for resistance, for example to shoot-borer.

DISTRIBUTION

The mapped distribution is taken from Mayhew and Newton (1998). Barros *et al.* (1992) estimated an average density of between 0.2 m^3/ha and 0.6 m^3/ha for areas of low to high density in areas of natural distribution. In addition to the natural distribution shown by the map, *S. macrophylla* has been introduced in other parts of the tropics as a timber species, as an ornamental and for horticulture, and has sometimes naturalized.

Species profile: *Cinnamomum cebuense*

Common Name: Cebu cinnamon, kaningag, kalingag
Scientific Name: *Cinnamomum cebuense*
Conservation Status: Unassessed

C. cebuense is a small to medium sized tree reaching a height of approximately 6 to 8 m, and is endemic to Cebu Island in the Philippines. It is a relatively new discovery, having been described by A.J.G.H. Kostermans in 1986 from a type specimen collected by an unknown collector on 27 March, 1971 in a mountain forest in the central part of Cebu Island.

It is a member of the family Lauraceae, a family known for its aromatic bark and leaves. Some of its members, including *C. camphora*, *C. parthenoxylon* and *C. glanduliferum*, are an important source of camphor and essential oils for the perfume and pharmaceutical industries. The bark of this particular species is used locally as a remedy for stomach ache, made by boiling the bark or chewing directly. It is also thought to be as potentially useful in a similar way as other species in the family due to the aromatic nature of the leaves.

One of the major threats facing the Cebu cinnamon is the destruction of its habitat. The prevalent practice of stripping its bark for medicinal use also poses a threat to its survival.

WHAT CONSERVATION ACTION IS NEEDED?

Despite the serious threat to the survival of the Cebu cinnamon tree, no conservation programmes have yet been implemented for its protection. In addition, no baseline studies regarding its population and distribution have been conducted as a basis for its protection. Studies are necessary to verify if it is also found in other forest fragments on Cebu Island. On the basis of this map and reported threats and forest loss, it is likely that this species could be classed as Critically Endangered (CR B12c): the extent of occurrence is estimated to be less than 100 km^2, there are indications that the habitat is severely fragmented and there has been a continuing observed decline in the area, extent and quality of habitat.

DISTRIBUTION

C. cebuense is only known from the forest fragments of Cantipla and Tabunan. Map distribution from William L.R. Oliver (pers comm. 2003), Director, FFI Philippines Programme.

Species profile: *Baillonella toxisperma*

Common Name: moabi
Scientific Name: *Baillonella toxisperma*
Conservation Status: Vulnerable (VU A1cd)

B. toxisperma is a monotypic genus with no closely related species; it is one of the largest tree species over its distribution, reaching a height of 60 m and a diameter of up to 5 m.

The species is heavily exploited primarily as a commercial timber, particularly in Cameroon and Gabon. In Cameroon, timber from *B. toxisperma* represents 10 per cent of companies' total production and between 3.4 and 5 per cent of the total export value of logs of all species. Gabon is the main exporter of *B. toxisperma*, exporting almost 40,000 m^3 in 1998. Demand for the timber is particularly strong in southern Europe. It is used for furniture, cabinet work, decorative flooring, turnery and carving, decorative veneers, joinery and store fittings.

The fruits of *B. toxisperma* are edible and are an important source of food for elephants and other forest mammals. It has been suggested that the seeds will not germinate unless they have first passed through an elephant. Extracts from the bark are also used to produce remedies for dental and back problems. Seeds from the fruit are used to make karité oil, which is used for both consumption and trade. In the larger cities in Cameroon, karité oil can be worth as much as US$ 12 per litre. The value of non-timber products of *B. toxisperma* has also been recognized by the French cosmetics industry, which has shown an interest in the oil.

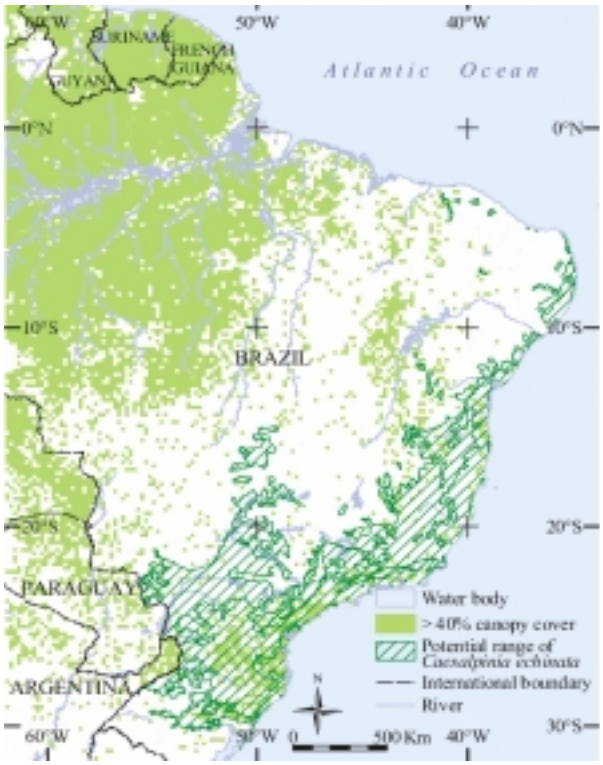
Logging is the main threat to *Baillonella*. The tree does not flower until it is 50 to 70 years old and produces fruit only once every three years. In some areas *B. toxisperma* has already been logged out. In Cameroon *B. toxisperma* within 5 km of a village cannot be logged unless the village chief agrees and the population is compensated but, in reality, trees have been lost and the population has received no compensation. Logging practices are generally unsustainable and *B. toxisperma* may disappear from a large part of its original areas of distribution in 10 to 20 years. In the Dja forests of Cameroon, nearly all valuable trees are logged without companies undertaking initiatives to ensure regeneration of the species.

WHAT CONSERVATION ACTION IS NEEDED?

At present logging companies are not complying with the law and the law itself may provide inadequate protection. In Cameroon, trees less than 1 m in diameter should not be logged; the figure is 0.8 m in Gabon and Congo. These limits may still leave the regeneration of *B. toxisperma* at risk. It is argued that the minimum diameter should be increased and measures introduced to conserve "mother trees" that can ensure regeneration. It has also been suggested that there should be a total ban on logging of *B. toxisperma. Baillonella* appears to fulfil the CITES listing criteria for Appendix II on the basis of unsustainable levels of trade. Refinement of the species map would help to determine the current status and suitability for listing.

DISTRIBUTION

Baillonella is endemic to the primary and old secondary rainforests of Central and West Africa. Although logged from most of this range, *Baillonella* is found in several protected areas in Cameroon (Forêt de Nki, Forêt de Boumba Bek and Réserve de Faune de Dja). The degree of protection throughout its range should be determined. Distribution information is taken from Vivien and Faure (1985) and Plenderleith and Brown (2000).



Species profile: *Caesalpinia echinata*

Common Name: pau Brasil, Brazil wood, brasileto, ibirapitanga, orabutá, pau Pernambuco, pau rosado

Scientific Name: *Caesalpinia echinata*

Conservation Status: Endangered (EN A1acd)

C. echinata is the national tree of Brazil, the country to which it gave its name, and has strong cultural links to Brazil's social and economic history. In the coastal forest ecosystems of Brazil the species has been noted as an important habitat for orchids and other epiphytes. It is famous for the dye extract taken from the heartwood, although synthetic dyes have now reduced this trade. The timber is now highly valued for the manufacture of bows for stringed musical instruments. Years of harvesting and loss of the Atlantic Coastal Forest have significantly reduced the populations of this species.

The extensive collection and export of the dyewood from the 16th to mid-19th centuries resulted in the loss of large areas of forest. By the time synthetic dyes became available in 1875, populations had declined dramatically and continued to do so until the 1920s; timber is still highly sought after by bow manufacturers. There are no reliable figures for the amount of wood currently exported, but the annual world demand is likely to exceed 200 m^3. The problem is exacerbated by the high level of wood wasted during processing; between 70 and 80 per cent is lost as

logs are converted to bow blanks, and a further 70 to 80 per cent is lost in processing these into bows. Clear-felling and logging also threaten the natural habitats of pau Brasil, and utilization by local people may be having a detrimental impact on population levels.

WHAT CONSERVATION ACTION IS NEEDED?

Pau Brasil is listed on the official list of threatened Brazilian plants by IBAMA, the Government wildlife agency which has also established legislation on felling and is investigating replanting opportunities. Despite its high profile, however, the species has been poorly studied, with little data available on distribution, species variation and population size. In 1997 FFI, with the Rio de Janeiro Botanical Gardens and the Margaret Mee Foundation, convened a meeting to develop an action plan for its conservation and management. Agreement was reached amongst all participants on the recommended actions relating to different aspects of its conservation and sustainable use. The Global Trees Campaign is now working with these partners and another non-governmental organization, Amainan Brasil, to carry out a detailed study of populations and distribution and to conduct local community education projects, with support from the Flagship Species Fund. A mechanism to check the legality of stocks in international trade is needed and pau Brasil appears to meet the CITES listing criteria.

DISTRIBUTION

Pau Brasil is confined to the Atlantic Coastal Forest, an ecosystem recognized as a global biodiversity hotspot. It inhabits coastal regions with open forest and well-drained soils. Detailed information on the present geographical distribution of pau Brasil is scarce, but in the last ten years remnant populations have been found in nine Brazilian states, including populations in reserves in Bahia and Pernambuco. Determining the previous range of the species has been problematic due to errors in the literature caused by incorrect identification and confusion with related species. The map here shows the potential distribution on the basis of Atlantic Coastal Forest range according to the WWF Global 200 Ecoregions data.

The way ahead

Information on the distribution and abundance of tree species is of primary importance in the planning and implementation of biodiversity conservation. The need for attention to be focused on rare and threatened species, for example within forest ecosystems, is recognized within the objectives and implementing mechanisms of the main international biodiversity conventions. The first international survey of the conservation status of tree species was carried out in the period 1995-98 by UNEP-WCMC in partnership with the Species Survival Commission (SSC) of IUCN-The World Conservation Union and a network of additional experts. A mechanism to update this information has recently been established through the creation of an IUCN/SSC Global Tree Specialist Group that has been set up to promote and take responsibility for tree species red listing and to act in an advisory capacity to the Global Trees Campaign. Tree conservation assessments by the Group will contribute to Target 2 of the Global Strategy for Plant Conservation (GSPC) of the Convention on Biological Diversity (CBD): the preliminary assessment of conservation status of all known plants by 2010. It will be a priority to assess tree species in geographical areas where red listing using global categories and criteria for trees has been limited in the past (for example in Central Asia, the Caribbean, Cameroon, Thailand, Philippines and the Pacific islands). At the same time a preliminary target for the Global Tree Specialist Group will be to re-evaluate all the species included in *The World List of Threatened Trees* by 2006, using the latest version of the *IUCN Red List* categories and criteria.

FFI and UNEP-WCMC, the lead partners in the Global Trees Campaign, will work together to collect spatial data and provide maps on rare, heavily exploited and culturally important tree species. The maps will be made available to support updated conservation assessments of tree species, national and international policy implementation and public awareness initiatives on the importance of biodiversity. Information on the distribution and abundance of tree species will be derived from the Campaign's existing field projects (for example in Brazil, the Caribbean, Central America, the Philippines and Viet Nam) and the development of new research initiatives in key areas. Information will also be accessed through collaboration and exchange with other organizations, for example the lead agencies identified to support implementation of the targets of the CBD GSPC. Particular attention will be paid to the development of standard approaches and better harmonization of data to increase the policy relevance and practical value of the maps produced. The use of geographic information systems (GIS) to link data from different sources, including herbarium data, species information from forest inventories and forest cover data, provides exciting opportunities. Capacity-building to ensure that local and national partners within the Global Trees Campaign have the ability to develop and maintain their own tree conservation planning tools will also be a key component of the mapping work.

Priorities for tree species mapping will be developed in consultation with international organizations and partners in the Global Trees Campaign at a national, regional and global level. Initial priorities will be to generate maps for tree species which are:

- listed in the Appendices of CITES;
- included in CBD National Strategies and Action Plans;
- identified as flagship species in the Global Trees Campaign;
- critically endangered and in need of urgent conservation attention;
- included in botanical families selected as indicators for global biodiversity assessment.

The mapping of individual tree species has a range of conservation applications as highlighted in this document. At the same time a new analysis or approach is required to identify priority areas for tree conservation based on species richness, endemism and threat, expanding on the preliminary analysis of conifer diversity and species distribution shown in the map on page 9. There is already sufficient information on certain woody plant families to develop such an approach on a selective taxonomic basis, for example looking at the Dipterocarpaceae, Fagaceae or Magnoliaceae. Consideration will also be given to highlighting areas where the maximum tree species diversity, taking into account full tree species inventories, can be conserved *in situ*.

The *Global Tree Conservation Atlas* will include maps and profiles of individual tree species of conservation concern together with regional and global maps highlighting priorities for tree species conservation. The processes of consultation, field research, capacity-building, data exchange and data integration leading to the production of the Atlas will in themselves support and promote tree conservation around the world. The publication of the *Global Tree Conservation Atlas* will provide valuable support to the implementation of conservation policy and a key public awareness tool.

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Abbreviations

C&I	Criteria and Indicators
CI	Conservation International
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
Defra	UK Department for Environment, Food and Rural Affairs
EBA	Endemic Bird Area
FAO	Food and Agriculture Organization of the United Nations
FFI	Fauna & Flora International
FSF	Flagship Species Fund
GIS	Geographic Information Systems
GSPC	Global Strategy for Plant Conservation (of CBD)
GTC	Global Trees Campaign
IBA	Important Bird Area
IFF	Intergovernmental Forum on Forests
IPA	Important Plant Area
IPF	Intergovernmental Panel on Forests
IUCN	IUCN-The World Conservation Union
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice (of CBD)
SSC	Species Survival Commission (of IUCN)
TWG	Timber Working Group (of CITES)
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFF	United Nations Forum on Forests
WSSD	World Summit on Sustainable Development

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Towards a **Global Tree Conservation** atlas

Mapping the status and distribution of the world's threatened tree species

This summary document outlines the need for spatial data on tree species as a tool for conservation action. It introduces plans for a tree species mapping programme that will build on the forest mapping information management expertise of UNEP-WCMC. A *Global Tree Conservation Atlas* will be produced as an output of the mapping programme and will be one of the main information outputs of the Global Trees Campaign (http://www.globaltrees.org).

The Campaign, a partnership between Fauna & Flora International and UNEP-WCMC, focuses on trees as flagship species for conservation of ecosystems and landscapes, and enables local people to carry out rescue and sustainable use operations. Working in partnership with organizations around the globe, the Global Trees Campaign aims to save the world's most threatened tree species and their habitats through information, conservation and wise use.

UNEP World Conservation Monitoring Centre
219 Huntingdon Road, Cambridge
CB3 0DL, United Kingdom
Tel: +44 (0) 1223 277314
Fax: +44 (0) 1223 277136
E-mail: info@unep-wcmc.org
Website: www.unep-wcmc.org

Fauna & Flora International
Great Eastern House
Tenison Road, Cambridge
CB1 2TT, United Kingdom
Tel: +44 (0) 1223 571000
Fax: +44 (0) 1223 461481
E-mail: info@fauna-flora.org
Website: www.fauna-flora.org

www.unep.org
United Nations Environment Programme
P.O. Box 30552, Nairobi, Kenya
Tel: +254 (0) 2 621234
Fax: +254 (0) 2 623927
E-mail: cpiinfo@unep.org
Website: www.unep.org

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