
# SEVENTY-SEVENTH
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# LIST OF ACRONYMS AND ABBREVIATIONS

**BA** - Bachelor of Arts
**BIOME** - The Medical, Health and Life Sciences Hub of the Resource Discovery Network
**BIOSIS** - Publishers of Biological Abstracts
**BP** - Before present
**BRAHMS** - **B**otanical **R**esearch **A**nd **H**erbarium **M**anagement **S**ystem
**CABI** - CAB International
**CAMCORE** - Central American and Mexico Coniferous Resources Cooperative
**CATIE** - Centro Agronomico Tropical de Investigacion y Enzeñanza
**CD-ROM** - Compact disc read-only memory
**DFID** - Department for International Development
**DFSC** - Danish Forest Seed Centre
**DG** - Directorate General (of the European Commission)
**DNA** - Deoxyriboneucleic acid
**DPhil** - Doctor of Philosophy
**DPS** - Department of Plant Sciences (Oxford University)
**EC** - European Commission
**ECI** - Environmental Change Institute (Oxford University)
**EU** - European Union
**FAO** - Food and Agriculture Organization of the United Nations
**FHO** - The Oxford University Daubeny Herbarium
**FRAXIGEN** - EU-funded ash genetics project
**FRP** - Forestry Research Programme (of DFID's Renewable Natural Resources Programme)
**GIS** - Geographical information system
**GM** - Genetically modified
**GUS** - Beta-glucuronidase
**HTTP** - Hypertext transfer protocol
**ICRAF** - International Centre for Research in Agroforestry
**IDRC** - International Development Research Centre
**IFF** - International Forest Forum
**IIED** - International Institute for Environment and Development
**INSPIRE** - **IN**teractive **SP**ecies **I**nformation **Re**trieval
**IPF** - International Panel on Forests
**IUFRO** - International Union of Forestry Research Organizations
**MSc** - Master of Science
**NERC** - Natural Environment Research Council
**NHBS** - Natural History Book Service
**OFI** - Oxford Forestry Institute
**OXF** - The Oxford University Fielding-Druce Herbarium
**PDR** - People's Democratic Republic
**PROSPECT** - **P**rogrammed **R**etrieval **O**f **S**pecies by the **P**roperty and **E**nd-use **C**lassification of their **T**imbers
**RAPD** - Random amplified polymorphic DNA
**RBG** - Royal Botanic Gardens
**RDE** - Rapid data entry
**RDN** - Resource Discovery Network
**RELMA** - Regional Land Management Unit
**TFT** - Tropical Forest Trust
**USAID** - United States Agency for International Development
**USDA** - United States Department of Agriculture
**WWW** - World Wide Web

# HIGHLIGHTS

Following last year's decision not to publish a formal paper copy of the Annual Report, the report for this year is available only on the Institute's web site. Readers may download any part of it. Detailed results of the Institute's research activities are published in journals, books, and Institute publications. Several staff members contributed consultancy reports for various agencies.

The Institute was delighted to receive two visits from the Vice-Chancellor, Forestry Dean and other academic staff of the Universiti Malaysia, Sabah. The two universities signed a Memorandum of Understanding to facilitate collaborative research and teaching.

The Institute gratefully acknowledges the generosity of the following individuals and institutions in providing funds for scholarships on the MSc course:- Mr Daniel Kemp (Timbmet); the Michael Jourdain TFT Scholarship; the Ernest Cook Trust; the Wills Trust; the Commonwealth Forestry Association; the Worshipful Company of Builders Merchants; and the Hosier Fund and the Norman and Ivy Lloyd Scholarship, both associated with Linacre College. The OFI Director and Mr Antwi Oduro (Ghana) gave a joint presentation to the Court of the Worshipful Company of Builders Merchants in London.

A lecturership in Forest Science was advertised but the University's financial situation precluded an appointment. This, together with impending retirements, precipitated consideration of the future of the Institute and the MSc course within the Plant Sciences Department and the Life and Environmental Sciences Division. Final decision are expected in 2002 but it can be reasonably inferred that external, non-University funding will be necessary to secure the continuation of the Institute.

During the year the Institute was sad to learn of the death of Mrs Hilda Pengelly, formerly secretary to Professor Jack Harley (OFI Director).

Three senior members of the Institute staff departed in September 2001. Dr Simon Pryor had been employed as Departmental Lecturer for four years teaching forest policy and organizing the management plan exercise for the MSc course. We wished him well as he took up his appointment as Policy Adviser to the Forestry Commission for England. Dr Richard Barnes, Senior Research Officer in Forest Genetics, retired after 24 years' service in which he completed several outstanding projects on the genetic resources of tropical pines and African acacias. Mr Howard Wright began work in the Institute in 1964 as Statistics Research Officer and retired 37 years later as Deputy Director. Both Richard Barnes and Howard Wright continue as part-time employees while completing the publication of their final DFID project reports but we wish them both well in their official retirements.

The Institute was the host for a period of sabbatical leave for Professor Steven Strauss (Oregon State University); he lectured to the MSc course and gave seminars to the Plant Sciences Department and three other institutions in England, Scotland and Wales. In Oxford he collaborated with several OFI staff in writing two papers on the controversial issues of genetic modification of trees within the framework of forest certification.

Finally I wish to thank all members of OFI staff for their loyal support and outstanding work in what will prove to be my last complete year as Director before I too retire in October 2002.

Professor J Burley
Director

# OXFORD FORESTRY INSTITUTE

## Department of Plant Sciences, University of Oxford

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# RESEARCH

## Ecology and Silviculture

| | |
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| **Research assistant:** | Mr T.J. Clements, Mr E.P. Mountford, Ms K. Plenderleith, Mr T. Rayden |
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| **Research students:** | Ms T. Alves, Miss C.J. Bampfylde, Mr S. Bhagwat, Ms T. Brncic, Mr T. Curtis, Mr T. Evans, Mr L. Fontes, Mr G.E. Hemery, Mr E. Mountford, Mr M. Olvera Vargas |

### Temperate ecology and silviculture

**The performance, constraints and potential of Douglas fir (*Pseudotsuga menziesii*) in Portugal**
*Researcher: Mr L. Fontes (DPhil student)*
*Supervisors: Dr P.S. Savill, Mr H.L. Wright and Dr S.A. Harris*

This research project is being carried out collaboratively between OFI and the Universidade Técnica de Lisboa, Instituto Superior de Agronomia (Dr M Tomé, Prof H. Pereira, Prof A. Oliveira and Dr H. Almeida) and Universidade de Trás-os-Montes e Alto Douro (Dr J. S. Luis). It is funded by the Portuguese Fundação Ciência e Tecnologia.

Dominant height of Douglas fir plantations in Portugal were modelled using nine growth models. Considering statistical and biological criteria, a McDill-Amateis model was selected to construct site index curves, based on data from 20 permanent sample plots and 87 stem analysis trees.

A provenance trial with Portuguese, US and Canadian provenances was established at Valença. The genetic diversity of Portuguese provenances was assessed through isozyme analysis of 300 trees from 10 stands. A generally common genetic background within the Portuguese provenances was found. It is possible to infer that Oregon is the most likely source of material for the majority of Portuguese Douglas fir plantations.

The use of site factor variables to estimate Douglas fir site index in Portugal, through multiple linear regression, has been assessed. Data from 43 plots at 15 sites across its distribution in Portugal were used. The "best" empirical, theoretical and practical models have been evaluated. To predict the potential area suitable for Douglas fir in Portugal, Douglas-fir site index has been modelled from digitized information on soils and climate at a national level through GIS techniques.

**Nature-based management of beech in Europe**
*Project Manager: Dr P.S. Savill*
*Principle Researcher: Mr E.P. Mountford*
*Consultants: Dr G.F. Peterken and Mr R. Pakenham*
*European Union 5th Framework Project*

This is a four-year programme (2000-2004) focussing on the sustainable management of beech forests across Europe and covering many aspects of beech ecology. It involves eleven partners from Denmark, Netherlands, Germany, Hungary, Slovenia and Britain. The project intends to (1) establish a natural reference point for beech management in Europe; (2) develop criteria and indicators for beech forest management; (3) evaluate and develop cost-effective tools for biodiversity management in beech forestry; and (4) produce management guidelines, policy recommendations, workshops and Internet services.

The main themes of the research are the management of gaps, the amount and distribution of dead wood in forests, and the use of 'nature-based forestry'. The OFI is involved with seven work-packages on (1) past-natural beech forests; (2) present-natural beech forest reference; (3) regeneration and ground vegetation dynamics; (4) forest landscape modelling; (5) management of beech; (6) review book; (7) scenario analyses.

During 2001 the OFI has worked on mapping the spread of beech forests across Europe since the last glaciation using numerous pollen diagrams. It has prepared literature reviews on natural regeneration, natural stand dynamics, and historical and contemporary management in British beechwoods. Fieldwork has included re-surveying permanent vegetation plots in Lady Park Wood, which were first established in 1944 by the Institute. Records were also made for beechwoods in southern England that were damaged in the Great Storm of October 1987. Gap-regeneration studies were initiated in beechwoods in the Chilterns and the Welsh borderlands. Various analyses and reports have been prepared. Work-package meetings were attended in the Netherlands and Denmark, and a representative joined the Core Management Meeting / Excursion in the Czech Republic.

### Long term re-structuring of Chilterns Woodlands

*Project Manager: Dr P.S. Savill*
*Research Assistants: Mr T.J. Clements and Mr T. Rayden*
*Funded by: TransNational Woodland Industries Group (TWIG) under the EU's Recite II Programme*

Modelling in the context of climate change has suggested that beech (*Fagus sylvatica*) could be lost from a large area of the Chiltern Hills, near Oxford. More drought tolerant species will have to be used in the future. Our task, financed by the EU, was to suggest what would be most suitable on various sites so that policies could be developed for ensuring that the woodland cover was not lost, either by planting or natural regeneration. The project also involved determining the amount and quality of timber likely to be available from the Chilterns.

Ecological Site Classification (ECS) provides a method for identifying sites that are suitable for particular species. It effectively follows the 'niche-assembly' theory of community structure. This perspective holds that communities are groups of interacting species whose community presence and relative abundance can be deduced from 'assembly rules' that are based on the ecological niches or functional roles of each species. ESC uses environmental variables - such as climate, soil characteristics and topography - to classify sites according to their potential for growth of different species. Unlike other systems, it is concerned with identifying potential, as opposed to classifying what is there now.

It combines separate classifications of climate, soil moisture regime and soil nutrient regime to predict the suitability of a site for different tree species. Using Geographical Information Systems (GIS), ESC can be extended to produce maps of environmental variables (e.g. soil type) at the forest or landscape scale, which can then be employed in the selection of tree species or woodland communities for establishment over these larger areas.

Various possible criteria to measure potential exist. The ones we used were of growth potential, and the potential for natural regeneration.

Ancient semi-natural woodlands in the Chilterns were sampled randomly, with stratification according to landscape topography (e.g. valley bottoms, slopes, plateaux). In total 293 plots were established, each of 0.02 ha. The results show that:-

- Ash, beech and oak grow best on soils of similar nutrient status - neutral soils of high fertility but with little free carbonate but a high available water capacity. At least with respect to growth, there was little differentiation between species.
- Ecological differentiation was much more obvious for the quantity of regeneration of ash and beech. Regeneration of ash is greatest in very alkaline soils, whereas beech does better on acid soils. Therefore, while only a restricted set of conditions gives greatest growth of all species, species differ with respect to their seedlings' abilities to survive.
- Although the greatest growth of ash, beech and oak occurs on soils with high available water content and a soil nutrient regime of 4.5, only ash appears to regenerate (and survive) well on these sites. If yield predictions alone were followed, this might lead to planting beech and oak on a site where survivorship of these species is low.
- Ash and oak are affected less by moisture availability and drought than beech.
- Topography (aspect and slope) are variables that account for a very large amount (c. 60%) of the variation in growth. South and west facing slopes are exposed to the prevailing westerly winds. These tend to accentuate the effects of shallow, very freely draining soils producing severe soil drought. By contrast, the north and east facing slopes are sheltered from the wind. Here, growth of tree is considerably greater.
- Topography has a much smaller effect on the abundance of young beech and ash regeneration. One exception is the marked influence of aspect on the abundance of ash regeneration. Prolific ash regeneration is found on very calcareous soils that are often very steep. There is a large difference between the abundance of regeneration on the moist north-east, compared with the south-west facing aspects that are exposed to the prevailing winds.

### Restoration of plantations on ancient woodland sites

*Researcher: Mr T. Curtis (DPhil student)*
*Supervisors: Dr N.D. Brown and Dr S.N. Pryor*
*Funded by: Woodland Trust*

See section on "Forest Policy and Management" on page 15.

## Tropical ecology

### The interactions of *Khaya anthotheca* and *Hypsipyla* in Mozambique

*Researcher: Ms T. Alves (DPhil student)*
*Supervisors: Dr P.S. Savill and Dr M.R. Speight (Zoology)*
*Sponsors: Ford Foundation and IDRC*

The objective of this study is to evaluate the potential of *Khaya anthotheca*, a mahogany, used in afforestation programmes and enrichment planting. The domestication of this species is hampered by its susceptibility to a shoot borer, *Hypsipyla* sp., which destroys the apices of the plants causing the formation of branches and forks, and affecting the form of the tree.

The research was carried out at Moribane, Manica Province (1300 km north from Maputo, Mozambique), an area where *Khaya anthotheca* occurs naturally.

Field trials were established and data is being collected in relation to survival, growth and susceptibility to attack, in relation to the following variables:-

- Aspect (east and west facing slopes), distance from perennial streams, and shade when young.
- Genetic origin - involving open pollinated progenies.
- Capacity for recovery from damage.

## Dipterocarp seedling survival in the understorey of a tropical rain forest

*Researcher: Mr D. Bebber (DPhil student)*
*Supervisors: Dr N.D. Brown and Dr M.R. Speight (Zoology)*

Some further work is still required before the thesis can be accepted.

## Biodiversity and conservation of a cultural landscape in the Western Ghats of India

*Researcher: Mr S. Bhagwat (DPhil student)*
*Supervisors: Dr N.D. Brown and Dr P.S. Savill*
*Funded by: The Conservation, Food and Health Foundation*

This is a collaborative research project between the OFI and the Forestry College in Ponnampet (Kodagu). The project is funded by a US-based charitable trust, the Conservation, Food and Health Foundation of Boston, Massachusetts.

The landscape in the mountain range of the Western Ghats of India has been managed, used and conserved by the local people for several centuries. Two separate systems of conservation exist in the region. The formal system of Government forest reserves is managed by the State Forest Department whereas the informal system of sacred forest patches has been a part of the religio-cultural tradition of the local inhabitants. The fieldwork for the present project was carried out in Kodagu, which is a coffee growing area. Although more than three-quarters of the land surface in Coorg is tree covered, more than one third of this area is under privately owned coffee plantations that retain tall native trees for shade. Over the past decade this coffee belt has undergone severe changes in vegetation composition and has been losing its native tree wealth. Sacred forest patches, therefore, are the last refuges of native vegetation in the lowland agricultural landscape. We are looking at the consequences of such long-term fragmentation of native vegetation for three distinct ecological groups of organisms, namely, woody angiosperms, diurnal birds and macro-fungi. The project investigates the relative effectiveness of the traditional conservation practice in relation to the government reserves and private plantations.

After completion of all necessary fieldwork at the end of the 2000, analysis of spatial information was embarked upon during 2001. The village-level maps were digitised and put together using MapInfo GIS software to make a landscape map for the study area. The co-ordinates of sampling sites obtained using GPS were superimposed on the base-map. Size and isolation of patches under investigation, as well as the composition and configuration of the surrounding landscape matrix, were quantified. The information was analysed in the context of diversity patterns in trees, birds and macrofungi. Analyses were also carried out on species belonging to different ecological groups and those having special conservation importance as well as utility value in Kodagu. The doctoral thesis is currently being written and it is hoped that this will be completed in early 2002.

## The ecology and patch dynamics of *Megaphrynium macrostachyum* (Marantaceae) in southwestern Central African Republic

*Researcher: Ms T. Brncic (DPhil student)*
*Supervisors: Dr N.D. Brown and Dr D. Harris (Edinburgh University)*

This project focuses on a particular forest type that is found in the south-west Central African Republic which has a high abundance of a giant forest herb, *Megaphrynium macrostachyum* (Benth.) M.-Redh. (Marantaceae). Although most species of tropical forest understorey herbs grow and reproduce more readily in sites that receive more light, *Megaphrynium macrostachyum* is unusual because of its occurrence in large monodominant patches, which appear to be capable of delaying tree regeneration in forest gaps.

Marantaceae forests are a recurring phenomenon in Central and West African forests, though the structure and species composition may vary from site to site. In Central Africa *Megaphrynium macrostachyum* often reaches high densities after logging, shifting cultivation, or fire, but its abundance in the closed forest of the Ndakan study area is unexplained by any recent evidence of such a disturbance. The main questions asked were: what conditions are responsible for the formation of these patches, and what are the mechanisms by which these herbs compete with other forest species?

A survey of herb distributions in relation to several variables such as soil type, topography and canopy cover was carried out over the 10 sq. km study area to determine if *Megaphrynium* densities were associated with certain environmental factors. This led to the discovery of abundant charcoal in the area, as well as several sites with pottery fragments dating back 600 and 2000 years BP. This indicates that *Megaphrynium* patches may be a persistent form of secondary forest resulting from past anthropogenic disturbance.

Several factors may enable *Megaphrynium* to compete with trees to form persistent monodominant thickets.

Production of a dense leaf layer, rapid resprouting of shoots from rhizomes after disturbance, below ground competition, light competition, and clonal growth may all help explain the occurrence of *Megaphrynium* patches. These mechanisms were tested by comparing the ability of planted tree seeds to establish in manipulated and control plots in *Megaphrynium* patches. Genetic fingerprinting using RAPD analysis is underway to determine the extent of clonality within patches.

### Mathematical modelling of rain forest regeneration dynamics

*Researcher: Miss C.J. Bampfylde (DPhil student)*
*Supervisors: Dr N.D. Brown, Dr D.J. Gavaghan (Computing Laboratory) and Prof P.K. Maini (Centre for Mathematical Biology)*
*Funded by NERC*

This is a collaborative research project between the OFI, the Centre for Mathematical Biology and the Numerical Analysis Group.

Rain forests exhibit enormous tree species diversity, but the mechanisms for establishing and maintaining such diversity are unknown. The aim of producing some simple mathematical models is to try and identify the key mechanisms that drive species diversity.

Extending previous models to describe an age-structured population has produced some interesting results. The model describes the time evolution of the population density of different tree species, stratified into four different age classes or cohorts: seedlings; saplings; adult trees; and over mature, quiescent trees. The system seems to decouple into two parts: the equations governing the seedlings and saplings, and those governing the trees. This would indicate that the two elements evolve on completely different timescales and that tree species diversity is governed by which saplings are present in the understorey, given that the composition of the canopy remains fairly constant over the lifetime of seedlings and saplings.

A complete census of Dr Nick Brown's permanent sample plots in Danum Valley, Sabah, Malaysian Borneo, provided an invaluable data set of seedling and sapling gap dynamics over 14 years (including small scale spatial structure). Validation of the model and parameter estimation was carried out using field data collected. Future work will include modification of the model to make it more realistic and improve on its shortcomings. For example, including spatial structure and interactions.

### Ecology and silviculture of Oak (*Quercus* spp. Fagaceae) and mixed Oak mountain forests in western Mexico

*Researcher: Mr M. Olvera Vargas (probationary research student)*
*Supervisors: Dr N.D. Brown and Dr P.S. Savill*

This ongoing project is taking place in Cerro Grande, Sierra de Manantlan, Biosphere Reserve in western Mexico (SMBR). The forest formations in this area are represented by species that can be found both in tropical and temperate forest ecosystems. However, one of the most interesting, promising and challenging vegetation types in the SMBR is the *Quercus* forest. It is not only because this genus is so conspicuous and diverse (approximately 34 species) in this area, but also it is because the oak and mixed-oak forest ecosystems are among the least studied in Mexico. Little is known about the basic ecological processes that underlie their dynamics. This project uses a dataset gathered from a system of 105 permanent sample plots ($500m^2$ each). These plots have been repeatedly inventoried with the aim to describe qualitatively and quantitatively the full range of structural variation and species composition; and to identify feasible patterns of canopy species composition with respect to stand, site and environmental characteristics. Emphasis is on investigating the performance of episodic regeneration successes and its subsequent recruitment into the adult stage as an approach to explain the co-existence of oak species. Preliminary results through multivariate analysis show that *Quercus* species do not tend to form species associations. Ordination analysis using non-metric multidimensional scaling on both only *Quercus* species and all species associated with *Quercus*, showed discrete (not clumped) patterns in species composition. A different perspective was observed when *Quercus* species were related to environmental gradients. Thus, these preliminary results suggest that even though it was not possible to identify specific *Quercus* communities, they do tend to be present on explicit environmental gradients.

### State of knowledge studies of high value non-timber forest products of Central Africa

*Project Manager: Dr N.D. Brown*
*Researcher: Ms K. Plenderleith*

Working with Kristina Plenderleith and two students, Dr Nick Brown prepared four "state-of-knowledge" reviews for the Central African Regional Programme for the Environment (CARPE). CARPE is a long-term initiative by USAID to address the issues of deforestation and biodiversity loss in the Congo Basin forest zone, in the middle of the African continent. This forest is under increasing pressure from population growth, logging, unsustainable resource use, poor management, and other problems related to poverty and political instability. The reviews on *Baillonella Toxisperma, Cola nitida, Cola accuminata, Irvingia gabonensis, Irvingia wombolu* and *Ricinodendron heudelotii*, cover the taxonomy, ecology, uses, markets and sustainability issues. They are to be published in 2002 as part of a multi-author book by USAID edited by Dr T. Sunderland and L. Clark.

## DPhil thesis submitted

## Taxonomic and ecological aspects of the sustainable management of wild rattan populations in Lao PDR

*Researcher: Mr T.D. Evans (DPhil student)*
*Supervisors: Dr N.D. Brown and Dr J. Dransfield (RBG Kew)*

Rattans are climbing palms (family Arecaceae, subfamily Calamoideae) that grow abundantly in the forests of tropical Asia and Africa. They are extensively harvested from unmanaged wild stocks, resulting in widespread declines. This threatens the survival of some species and the commercial viability of many others. Conversely, sustainable rattan harvesting has been said to promise an economic incentive to resist deforestation.

This study investigated three related fields where the information needed to support better management was lacking. The first was taxonomy. A review was made of the validity and identification criteria for all taxa recorded from Indochina, based on herbarium and field work. Eight new species were identified and named amongst the fifty species now recognised from Indochina, whilst a better appreciation of individual variation plus the opportunity to compare specimens from across the region led to many existing names being synonymised. The improved taxonomy has enabled the collation of information on ecology, uses and threats whilst providing a stable base for further research.

The second field was the development of efficient methods for collecting data on population sizes and growth rates for management planning. Trials of standard plot-based density surveys indicated very high time costs, especially at the level of precision needed to detect declining populations. This raises doubts over the practicality of this approach, especially with a sparse, patchy population of a relatively low value plant growing in extensive, hilly forest. Since permanent plots are a difficult, costly way to estimate rattan growth rates, two cheaper methods based on temporary plots were trialled. One, the internode cycle method, was found to be ineffective. However, the flowering interval method (which is based on the concept that the stem length between the starting points of successive runs of inflorescences represents annual growth) gave good results and deserves further development.

Finally, a study of the abundance and productivity of a population of the small-diameter commercial species *Calamus solitarius* indicated low projected economic returns from sustainable harvesting (less than US$ 0.5/ha/year). Although the population density was lower than at many sites reported in the literature, a combination of evidence suggests that the productivity of many other Lao populations is likely to be comparable. The potential of rattans to affect economic decisions on land-use thus seems likely to be minimal.

# Forest Genetics and Tree Improvement

**Academic staff:** Prof J. Burley
**Research staff:** Dr R.D. Barnes, Mr D.L. Filer, Ms J.L. Stewart
**Botanical artist:** Mrs R. Wise

## Germplasm acquisition and evaluation

### African acacias - monographs and manuals

*Project Manager: Prof J. Burley*
*Lead Scientist: Dr R.D. Barnes*
*Researcher: Mr D.L. Filer*
*Botanical artist: Mrs R.Wise*
*DFID Project R.7275*

The objectives of this project are to publish information collected, and results of experiments conducted, in the six DFID FRP projects on the African acacias. These started in 1987 and have progressed from exploration, taxonomic studies and seed collection through distribution, genetic evaluation and assessment of potential to dissemination of the materials and information. Three works will be published in this project:- monographs and annotated bibliographies on *Faidherbia albida* and *Acacia senegal* (and the gum arabic trade) and a handbook on the ecology, uses and culture of the acacias of south central Africa for forestry and agricultural extension workers, small scale farmers and teachers. In addition, the final draft of a major work on a conspectus of the African acacias as a whole will be produced. The project draws on the experience of sixteen external collaborators who are being contracted to contribute to the publications.

During 2001, work continued on all four publications. The annotated bibliographies for *Faidherbia albida* and *Acacia senegal* were completed and progress was made in writing the monographic sections of the publications. The text and illustrations for the handbook were handed to the publisher and by the end of December the book had been formatted and the cover design discussed. The scope of the handbook has been extended from Zimbabwe along to "south central Africa", more specifically, the drier Caesalpinoid woodland area of the region. Steady progress was made on the species treatments for the conspectus and new software was acquired to produce the species distribution maps. A base map was completed by the end of the year; this map can easily be modified in scale and detail to suit the distribution characteristics of each species. The conspectus is modular in its structure with the intention that regional or country field guides can be produced for subsets of species as was done for Zimbabwe in the previous project. The intention is that local authors can be recruited to take a lead in producing these field guides and they will add the local flavour to our illustrations, maps and botanical descriptions. A start was made with the production of a field guide for the acacias of Uganda in collaboration with taxonomists at Kew and in Uganda.

The completion date for the project is 31 March 2003 but progress has been slower than anticipated because of delayed availability of some of the collaborators and the security situation in Zimbabwe, the project's field base.

## Qualitative analysis of agroforestry species for fodder

### Investigation of factors affecting the nutritive value of *Calliandra calothyrsus* leaf as fodder for ruminants

*Project Manager: Ms J.L. Stewart*
*DFID Project R.6549*
*Collaborators: ICRAF, Nairobi, Kenya and RELMA, Nairobi, Kenya*

*Calliandra calothyrsus* is a tropical leguminous tree which can provide dry season leaf fodder of high nutritive value. In Phase I of the project we investigated effects of management and environment on the nutritive value of two high-yielding provenances of *Calliandra*, through a combination of feeding trials in Colombia and Kenya, and analytical studies, particularly of the tannin chemistry of the leaf, at the University of Reading. The two provenances were shown to differ in leaf digestibility, in levels of protein, fibre and tannin, and most importantly in their effect on meat and milk production. Drying of the leaves, however, which has been widely reported to reduce digestibility, has been found to have no significant effects. These studies suggested that it is not essential to feed *Calliandra* immediately after harvesting, as is widely recommended, giving much greater flexibility in the way it is used, particularly in cut-and-carry systems.

Having confirmed the high potential of *Calliandra* as a fodder supplement, and in view of the high rate of its adoption by smallholder dairy farmers in the Central Highlands of Kenya and parts of Uganda, a follow-up phase of the project started in July 2001 with the objective of promoting the use of *Calliandra* and other fodder trees more widely in the region. The main focus of the project is the Lake Victoria Basin area of Western Kenya, but it is also active in several other parts of Kenya and in Uganda, Rwanda and Ethiopia. In addition to village-level extension activities the project will undertake studies of *Calliandra* adoption and impact at several sites in these countries.

# Forest Biodiversity and Plant Systematics

**Academic staff:** Dr S.A. Harris
**Research staff:** Dr D.H. Boshier, Ms J.L. Stewart, Dr W. Hawthorne
**Research assistant:** Mr J. Cordero-Salvado

## Reproductive biology and genetic diversity

### Mesoamerican tree species: a source book for farm planting and ecological restoration

*Project Manager: Dr D.H. Boshier*
*Dissemination Coordinator: Dr Andrea Schlönvoight (CATIE)*
*Source Book Coordinator: Mr Jesus Cordero-Salvado*
*DFID Project R.7588*

The highly diverse biological, cultural, environmental and socio-economic conditions encountered across Mesoamerica demand diverse approaches to sustainable farming. Trees are a vital component of most Mesoamerican farming systems, but often only a simple or limited range of management options and species are currently promoted by forestry projects. Many national, regional, and even global compendia have compiled information about useful trees. However, few have defined 'utility' from a farmer perspective based on farmer surveys. Species selection has usually been based on the authors' expertise and agenda, and often implies promotion of a restricted set of exotic species. Many have questioned the wisdom of this approach and highlighted its risks (e.g. invasiveness, lack of diversity). Furthermore, most such compendia emphasise technical aspects of tree planting and establishment, with little consideration of the context in terms of farming systems and farmer constraints and preferences, and do not provide specific indications of which species appear best suited to the many different reforestation options (e.g. small blocks, living fences, trees in fields/pasture, natural regeneration). The project is based on the existence and synthesis of a large body of both published and unpublished information, while the selection of species covered is based on farmer preferences, as expressed in a large number of existing farmer surveys from within the region.

The objectives of the project are to: a) make available current knowledge of Mesoamerican tree species and their role in on-farm planting, ecological restoration and natural regeneration; b) ensure effective dissemination and uptake of that information. The project draws upon a diverse team with many years of experience in farming systems, socio-economic aspects, farmer decision-making processes, agroforestry, ecology, silviculture, taxonomy and genetics within the Central American region. OFI is coordinating the production of the *Source Book*, whilst CATIE is responsible for the overall coordination and implementation of the training/extension material component of the project. The Source Book will be available in Spanish, with a supporting CD-ROM containing photographic and drawing images to facilitate the production of extension materials. The dissemination materials will be developed and tested in close cooperation with a large number of collaborators and through existing extension networks in each country. A project web page has been set up at http://arbolesmesoamericanos.port5.com giving basic information about the project, and a separate one on http://uk.geocities.com/lysilomauk.

### FRAXIGEN - Ash for the future: defining European ash populations for conservation and regeneration

*Project Manager: Ms J.L. Stewart*
*EU Project EVK2-CT-2001-00108*
*OFI/Plant Sciences staff: Dr D. H. Boshier, Mr J. Cordero Salvado, Dr S. A. Harris, Dr J. R. Pannell, Dr S. Rendell, Dr P. S. Savill.*
*Collaborators: Forest Research Institute (NAGREF), Thessaloniki, Greece; Aristotelian University of Thessaloniki, Greece; University of Göteborg, Sweden; Consejo Superior de Investigaciones Científicas, Valencia, Spain; University of Valencia, Spain; Forestry Commission, UK; Swedish Agricultural University, Umeå.*

The FRAXIGEN project started in November 2001. Its broad aim is to strengthen the scientific basis for the sustainable conservation and regeneration of European *Fraxinus* populations through a fuller understanding of the dynamic biological and ecological processes which have shaped them. The specific scientific objectives are:-

1. To study patterns of gene flow and genetic diversity in three European *Fraxinus* species, and how these are influenced by variation in reproductive systems.
2. To study how natural ash populations have adapted to their environment, and how anthropogenic selection for productive characters has affected adaptive variation.
3. To provide guidance for governmental, private and public interest groups on the collection, exploitation, and conservation of ash genetic resources.

Partners in Sweden, Greece, Spain and UK will carry out their research in parallel on all three native European ash species: *Fraxinus excelsior* in Sweden and UK; *F. angustifolia* and *F. ornus* in Spain and Greece. The project will use a combination of molecular techniques to estimate genetic diversity and to investigate mating

system, gene flow and inbreeding depression; field- and lab-based studies of reproductive biology; and sets of reciprocal transplant experiments (RTEs) in which seed from eight ash populations is planted in field trials within the same eight woodlands, to investigate the geographical scale at which localised adaptation occurs. The first activity to be completed in UK was the collection of seed for the RTEs from ten *F. excelsior* populations in England, Wales and Scotland, eight of which will be selected for trials.

### Disposal of the Oxford Forestry Institute (OFI)/Department of Plant Sciences (DPS) Oxford collection of tree/shrub/liana seed

*Project Managers: Dr D.H. Boshier and Dr C.E. Hughes*
*DFID Project R.6551*

This activity rationalizes the OFI/DPS seed collections assembled with FRP funding. It includes; a) creation of a seed documentation archive at DPS, b) germination tests of particular species to provide long term storage data, c) transfer of remaining seed to appropriate organisations, with hard copy documentation and data base files. Rationalisation is guided by the principle of achieving the greatest possible developmental benefit, which predominates over research purposes.

Germination tests of larger bulk provenance pine and *Liquidambar styraciflua* seed collections were conducted and the results used to inform disposal of non-viable lots. Germination tests were also conducted to generate new information on long term storage of *Bombacopsis quinata*, *Cedrela odorata* and *Cordia alliodora*. Following discussions it was agreed that ICRAF will be the principal recipient of the legume seed, while Zimbabwe has also received some lots not requested by ICRAF. DFSC will be the principal recipients of the pine seed, while discussions with CAMCORE, China, Mexico, and Zimbabwe led to suitable arrangements for allocation of the remaining seed. A small quantity of the remaining seed, for which no further developmental benefit is perceived, will be incorporated into the Plant Sciences herbaria collections for future research. All transfers are subject to development of suitable Material Transfer Agreements and Letters of Agreement.

## Field Guides

### Guide to Plant Field Guides: comparison and development of tropical forest plant guide formats with a handbook to assist future production of field guides

*Project Manager: Dr W. Hawthorne*
*Researcher and botanical artist: Mrs R. Wise*
*DFID Project R.7367*

The 'Field Guides' project is funded by the UK Department for International Development (DFID) under their Forest Research Programme (FRP). The aim is to produce a hand book to facilitate production of field guides suitable for various groups of users, based partly on the results of empirical trials with various user groups, guide formats, and sets of species. We are producing a range of small guides ('guidelets') to groups of plants as a basis for empirical testing of the relative values of various formats. Tests of a variety of guide formats, for accuracy, useability and user appreciation were conducted in 2001 in Ghana, Grenada and Cameroon.

# Forest Biotechnology

**Academic staff:** Dr M.M. Campbell
**Post doctoral research:** Dr A. Patzlaff, Dr M. Poole
**Research students:** Ms A. Collins, Ms H. Jones, Ms L. Juda, Ms K. McMahon, Ms L. Newman, Ms L. Rogers, Ms C. Smith
**Technical staff:** Mrs C.M. Surman

## Exploration of molecular controls in plant growth and development

The control of plant growth and development is of interest from both a biological and an industrial perspective. Our work is focussed on understanding a subset of the molecular mechanisms that underlie plant growth and development, with a particular emphasis on how those processes are controlled in trees. In addition, we use our data to devise strategies for the biotechnological improvement of tree species for industrial end-uses. We use a combination of biochemistry, molecular genetics and functional genomics to provide insights into several aspects of tree growth and development. The major interests of our group include:-

### The control of wood formation

*Researchers: Dr A. Patzlaff, Dr M. Poole, Ms L. Juda, Ms K. McMahon, Ms L. Newman (graduated 2001) and Ms L. Rogers*

All land plants produce a woody tissue called xylem. This tissue plays a crucial role in both the physical support of the plant and in the transport of water and solutes throughout the plant body. Furthermore, xylem forms the foundation of the multibillion pound industries involved in the conversion of wood to pulp, paper, timber and energy. Our work focusses on understanding the molecular mechanisms that underlie the formation of xylem. These studies are providing important insights into the development of land plants, and are revealing means by which xylem formation could be modified for improved industrial properties.

Our work on wood formation makes use of trees such as eucalyptus, poplar and pine as well as the model plant *Arabidopsis thaliana*. Our work in this area has two foci. In the first, we are investigating the functions of two members of the MYB family of transcription factors, which were identified in differentiating pine xylem. We hypothesise that these two MYB proteins function to regulate aspects of xylem formation. More specifically, our results point to the involvement of these MYB proteins in the regulation of the formation of lignin during xylem formation. Current work is involved in testing hypotheses related to the functions of these MYB proteins, and the regulation of the corresponding genes, using biochemical and genetic approaches. Furthermore, we are devising strategies that use the MYB proteins with an aim to alter the properties of wood to enhance the conversion of wood biomass to usable energy.

The second focus of our work on wood formation involves the analysis of mutants with altered accumulation of lignin in xylem cells and in the sclerified parenchyma. We have been able to identify arabidopsis mutants with altered patterns of lignin accumulation. So far, we have been able to identify three non-allelic mutants that exhibit dramatically altered patterns of lignin accumulation. Current research is focussed on the characterisation of these mutants, and is providing important insights into the regulation of lignin accumulation. This work was supported by the Biotechnological and Biological Sciences Research Council (UK).

### The control of maturation in trees

*Researcher: Ms A. Collins (graduated 2001)*

Great progress has been made in delineating the mechanisms that underlie events related to maturation, such as the transition to flowering and changes in plant architecture, in herbaceous annual plants. In contrast, very little is known about the molecular mechanisms which control this phase transition in day-neutral, perennial plants like trees. This project is directed toward testing the hypothesis that the function(s) of the genes that control maturation in a daylength-dependent flowering plant, arabidopsis, are conserved in a day-neutral plant, eucalyptus. So far we have been able to clone and characterize two eucalyptus genes that are orthologous to genes involved in the control of phase transition in herbaceous annual plants such as arabidopsis. These genes encode proteins that are members of the CENTRORADIALIS and TERMINAL FLOWER family of phosphatidylethanolamine binding proteins. We have been able to demonstrate that these eucalyptus genes can function to affect phase change using molecular genetic experiments. Current work is aimed at fully characterizing these genes and their gene products and at identifying other members of this important family of genes. This work was supported by Shell Forestry.

### The control of growth and form in trees

*Researcher: Ms H. Jones*

The activity of meristematic tissues plays a major role in determining the form and rate of growth of all plants. This project is aimed at testing the hypothesis that a subset of the genes shown to be involved in establishing and maintaining vegetative meristems in *Arabidopsis thaliana* have functional orthologues in eucalypts. We have been able to clone and characterize a eucalyptus gene encoding a member of the KNOTTED and SHOOTMERISTEMLESS family of homeobox proteins. Current work is aimed at testing hypotheses related to the role of this gene in regulating the activity of primary and secondary meristems in eucalyptus. These studies will be an important first step in understanding the role of meristem activity in the control of tree growth and form. This work was supported by Shell Forestry and by the Biotechnological and Biological Sciences Research Council (UK).

### Virus-induced post-transcriptional gene silencing in perennial plants

*Researcher: Ms C. Smith*

The discovery that plants can use post-transcriptional gene silencing (PTGS) as a defence against viral pathogens has been one of the most interesting discoveries in plant pathology in recent years. To date, examination of virus-induced PTGS (known as virus-induced gene silencing or VIGS) has been limited to herbaceous annuals of to Solanaceae and Brassicaceae. These studies have revealed that VIGS is systemic and persistent, but that VIGS is not dependent on either systemic infection by, or persistence of, the viral pathogen. It is thought that this defence strategy is widespread, and is likely to be used by many diverse plant genera. If this is true, the implications of PTGS as a defence mechanism in perennial plants are significant. The ability to mount and sustain a defence against pathogens, for the lifetime of the plant, could be an important component of survival for woody perennial plants which may live for decades, or even hundreds of years. A defence mechanism like PTGS could account for the durability of resistance to viral pathogens that is characteristic of many woody perennials. However, it remains to be determined if VIGS operates in woody perennial plants. Currently our lab is in the process of testing this hypothesis in a project supported by the Biotechnological and Biological Sciences Research Council (UK) and by CellFor Inc. of Vancouver, BC, Canada.

## Successful DPhil thesis

### *MYB* misexpression links the spatial control of lignification with photomorphogenesis

*Researcher: Lisa JoAnne Newman (DPhil student)*
*Supervisor: Dr M.M. Campbell*

As part of studies to investigate the molecular mechanisms underlying xylem formation, a cDNA encoding a MYB transcription factor was isolated. This MYB, *Ptx*MYB413, was expressed in differentiating *Pinus taeda* xylem. *Ptx*MYB413 function was investigated by ectopically overexpressing the MYB cDNA in arabidopsis. The constructs used consisted of either a full-length cDNA, designated *PtxMYB413T*, or a putative dominant-negative construct consisting of only the portion of the cDNA that encodes the N-terminal DNA-binding domain, *PtxMYB413N*. Phenotypic characterization of transgenic arabidopsis plants overexpressing the dominant-negative construct, *Ptx*MYB413N, revealed that the transgene induced novel changes in the rate of maturation. Transgenic plants overexpressing the *Ptx*MYB413N construct exhibited a heterochronic shift in the timing of changes in leaf morphology, lignification, flowering, and seed set. In contrast, plants overexpressing the full-length *MYB* cDNA, *Ptx*MYB413T, had many pleiotropic defects, including ectopic lignin deposition, and a dark-photomorphogenic response.

In order to gain a better understanding of the mechanisms underpinning the timing and localization of lignification, an arabidopsis mutant in which lignin localization was altered was characterized. This mutant was the previously characterised dark-photomorphogenic mutant, *de-etiolated 3* (*det3*). Since the *det3* mutant and the *Ptx*MYB413T transgenic plants shared many of the same mutant phenotypic traits, it suggested that an arabidopsis MYB might be involved in generating at least some aspects of the *det3* mutant phenotype. An arabidopsis MYB, *At*MYB61, was found to be important in the manifestation of the *det3* phenotype. *At*MYB61 was misexpressed in the *det3* mutant background. In order to determine if such misexpression could explain the mutant phenotype, *At*MYB61 was overexpressed in wild-type arabidopsis plants. Wild-type plants overexpressing *At*MYB61 had the same ectopic lignification and dark-photomorphogenic phenotype as that of the *det3* mutant. In order to test if *At*MYB61 were necessary for the ectopic lignification phenotype, *det3* plants were stably transformed with an antisense construct designed to specifically down-regulate *At*MYB61. Antisense suppression of *At*MYB61 in a *det3* mutant background restored all mutant phenotypes of the *det3* mutant associated with development in the dark. Thus, the misexpression of *At*MYB61 was found to be both sufficient and necessary to explain the ectopic lignification and dark-photomorphogenic phenotype in the *det3* mutant. Finally, in order to test the hypothesis that the pine MYB, *Ptx*MYB413, and the arabidopsis

MYB, *At*MYB61, are functionally orthologous, the phenotypes of arabidopsis plants overexpressing the *PtxMYB413* cDNA or the *AtMYB61* cDNA were compared.

## Maturation-related genes from eucalyptus

*Researcher: Angela Joyce Collins (DPhil student)*
*Supervisor: Dr M.M. Campbell*

Woody perennial plants are highly divergent in form from herbaceous annual species. However, both types of plant diverged from a common ancestor and pass through similar phases of development from the juvenile vegetative phase to the mature reproductive phase. Genes controlling the progression through the growth phases have been extensively characterized in the herbaceous annual species arabidopsis. One gene known to be important in phase transition in arabidopsis is *TERMINAL FLOWER 1* (*TFL1*). In wild-type arabidopsis, *TFL1* delays the transition from vegetative to reproductive growth and acts at the plant apex to maintain an indeterminate pattern of growth.

*TFL1*-like genes have also been found to be important in determining the timing of phase transition and inflorescence architecture in other herbaceous species. This thesis investigates whether or not *TFL1*-like genes are present in the woody perennial plant, eucalyptus. Three *TFL1*-like genes were isolated from eucalyptus, all of which show a high level of identity with *TFL1*. These genes are referred to as *Eucalyptus TFL1/CENTRORADIALIS-Like* genes and are designated *ETCL1*, *ETCL2* and *ETCL3*. Two of these genes were overexpressed in arabidopsis and the resultant plants shared many characteristics with each other and with plants that overexpressed *TFL1*. These findings revealed that *ETCL* genes shared functions with *TFL1*, and had the ability to delay phase change considerably. Furthermore, overexpression of *ETCL1* and *ETCL2* in a *tfl1* mutant background complemented some of the mutant phenotypes.

The pattern of gene expression directed by the *ETCL* promoters was investigated by the introduction of reporter (GUS) gene fusions into arabidopsis. Resultant transgenic plants revealed that the *ETCL1* promoter directed GUS expression in a similar pattern to that of the *TFL1* promoter; whereas, the *ETCL2* promoter directed GUS expression in a different pattern.

Transformation of the *tfl1* mutant with the *TFL1* promoter fused to the *ETCL1*, *ETCL2* or *TFL1* genomic coding region failed to complement the mutant phenotype, suggesting that the *TFL1* promoter was insufficient for *TFL1* expression. Motif searches of this region revealed an SV40 core enhancer element was located in the *TFL1* 3' region. Inclusion of this region in promoter GUS fusion constructs increased the percentage of transformants showing GUS activity, consistent with this region having enhancer activity. The level of *TFL1* expression has been proposed to be important in the control of flowering time and therefore it is likely that the enhancer is of importance in determining both the timing and the inflorescence structure of a plant.

# Forest Policy and Management

**Academic staff:** Dr S.N. Pryor
**Research students:** Mr T. Curtis, Mr M. Markopoulos

## Certification

*Collaborator: Prof S. Strauss (Oregon State University)*
*Researcher: Mr M. Markopoulos (DPhil student)*
*Co-supervisors: Prof J. Burley and Mr S. Bass (IIED)*
*Funding sources: DFID and IIED*

Forest certification is now a major issue and/or initiative in most countries of the world. It is intended to provide a market driver for sustainable forestry by enabling consumers to choose to use timber from well managed sources. This involves setting standards for sustainable forestry in each region or country, and providing assurance through auditing and chain of custody from source to supermarket shelf.

Matthew Markopoulos's research has focussed on the role of certification in supporting community-based forest enterprises in central America. One of his main findings is that certification was not providing significant market opportunities or premium for the certified enterprises. However, there were other benefits associated with being certified, such as reinforcing communities attempts to have their forest tenure recognized.

The Forest Stewardship Council does not allow use of genetically modified material in certified forest, even for research purposes. Professor Steve Strauss was on sabbatical in Oxford and in collaboration with Professor Burley, Malcolm Campbell and Peter Coventry, two papers were produced exploring and challenging some of the reasons behind this decision. These considered the risks associated with GM crops in the light of the risks associated with other practices that are allowed.

## Restoration of plantations on ancient woodland sites

*Project Managers: Dr N.D. Brown and Dr S.N. Pryor*
*Research Assistant: Mr T. Curtis*
*Collaborators: Forest Surveys, Forestry Commission*
*Funded by: Woodland Trust*

Ancient woodland sites which were converted to conifers during the second half of the 20th century still contain remnants of their ancient woodland biodiversity communities. As the economic viability of conifer plantations falls there is growing interest in restoring these sites to native woodland.

The first component of this research programme was to combine data from the National Inventory of Trees and Woods with the Ancient Woodland Inventory in order to provide new data on the area, distribution, composition and ownership of these plantations on ancient woodland sites. This will be central to devising any national and regional strategies for restoration, and for assessing the economic impacts.

The other component related to policy was an analysis of the economic implications of restoring conifer plantations to native woodland. This involved constructing a large number of different economic models, covering different conditions, crops and restoration treatments. These were analysed and compared using various indicators of profitability, including a novel parameter of 'mean (net) annual income'.

The third component of this project was a review of the silvicultural and ecological factors relating to restoration.

## 'Wildwoods' - the feasibility and desirability of creating native woodland by low intensity techniques

*Project Managers: Dr S.N. Pryor*
*Collaborators: Dr N.D. Brown, Dr George Peterken (Associate Member) , Dr A. Scott (Aberystwyth) and Dr R.W. Worrell (Edinburgh)*
*Funding Sources: Consortium of UK countryside agencies (Countryside Agency, Countryside Council for Wales, English Nature, Environment Agency and Scottish Natural Heritage)*

This is a study of the feasibility of creating new 'wilderness woodlands'. These will be extensive areas of woodland comprising native species, and established using low intensity silvicultural techniques such as natural regeneration/colonization. The study appraised all the relevant factors, identifying obstacles and opportunities. It also reviewed examples and experience to date, and proposed some possible pilot areas.

## Carbon sequestration in native woodland

*Principal investigator: Dr S.N. Pryor*
*Project manager: Dr Terry Dawson (ECI)*
*Research student: Genevieve Patenaude*
*Undergraduate project student: Brian Briggs*
*Funding source: British National Space Agency LINK programme*

OFI's role in this project is to provide estimates of the carbon sequestered in native woodland using conventional mensuration and biomass estimation techniques. These will be used to 'ground truth' estimates using remote sensing techniques, primarily synthetic aperture radar. This involved estimating stem and branchwood timber volumes, shrub and field layer vegetation and soil organic matter, and converting these

to carbon weights. The field site used was Monkswood National Nature Reserve.

### Implementation of the IPF/IFF Proposals for Action by the European Commission

*Principal investigator: Dr S.N. Pryor*
*Collaborators: Dr Ewald Rametsteiner (Vienna); Helga Puezl (Vienna); Thomas Schneider (Hamburg)*
*Funding Source: European Commission, DG Environment*

This study, led by the Institute of Forest Policy in Vienna, was commissioned by the EC to assess the extent to which the European Community had fulfilled its obligations in implementing the Proposals for Action agreed by the IPF and subsequently IFF. This involved an analysis of the relevance of each of the Proposals for its relevance to the EC. This was followed by an assessment of relevant work done by the EC, and this led onto a 'gap analysis' identifying the areas where further efforts might be necessary if full implementation was to be achieved.

## Successful DPhil thesis

### The role of certification in supporting Community-based Forest Enterprise (CFE) in Latin America

*Researcher: Mr M. Markopoulos*
*Supervisors: Prof J. Burley, Mr S. Bass (IIED)*

Certification is a relatively new, voluntary procedure in forestry, designed to link market demands for sustainably produced forest products with producers who can meet such demands. Although interest in, and support for, certification of community-based forest enterprises (CFEs) is growing, no systematic assessment of the impacts of certification on such enterprises has been attempted. In the first significant contribution to this area of inquiry, this study analyses the interaction between certification and CFEs in Bolivia, Honduras and Mexico. The proposition that the risk-averse business culture and weak export market linkages of most CFEs will limit the utility of certification is tested.

Certification of the enterprises in this study has been driven primarily by donors and non-governmental organizations. These parties have organized and financed the certification process, often with limited participation by the putative beneficiaries of the process. Certification has revealed that the enterprises have made good progress in organizing and coordinating forest management, but that their systems of management still lack sound empirical foundations. Certification bodies have tried to improve the scientific rigour of management, but the required pace and scale of improvement have frequently overwhelmed enterprise capacity and made further external intervention necessary.

Although certification has been undertaken to strengthen enterprise marketing efforts, subsidiary goals such as validation of management practices and enhancement of professional status have figured prominently. Contrary to expectations, the commercial impact of certification has been limited by a shortage of skills, information and capital within each enterprise. Sector-level cooperation, coupled with demand-driven support from buyers of certified products, may allow CFEs to overcome these constraints, but fundamental differences will remain between the commercial opportunities offered by certification and the social and economic goals of most CFEs. This study concludes that, external support for certification notwithstanding, most CFEs should concentrate their efforts on supplying domestic markets.

# OTHER RESEARCH ACTIVITIES

**Academic staff:** Mr P.J. Stewart, Mr F.B. Thompson
**Academic-related staff:** Mr H.L. Wright
**Research staff:** Ms N. Baker

## Ecophysiology

**Academic staff:** Mr F.B. Thompson

In July 2001 work was carried out with two post-graduate students at 15 sites in northern Portugal to investigate the relationships between site factors and the growth of Douglas fir. 60% of the inter-site variation was linked to air temperature, soil phosphorus and net soil moisture.

Collection of field data on kiln performance was halted by wind damage to the experimental kiln whilst it was open. The kiln is currently being repaired to allow further work on the improvement of the simulation model of solar wood drying kilns, with particular reference to mass transfer *i.e.* water movement in the liquid and vapour phases. The current thermal model can be used for a wide range of structures in relation to heat gains and losses by radiation (short and long wave), conduction and free and forced convection.

## Biometrics and Inventory

**Project Manager:** Mr H.L. Wright

*Project Manager: Mr H.L. Wright*
*Research Assistant: Ms N. Baker*
*Consultant: Dr D. Alder*
*DFID Project R.7278*

In collaboration with Dr Denis Alder, the project aims to develop a simple methodology for estimating the potential yield from a tropical moist forest when there are only data available from one point in time and to present this in the form of a manual. Estimation of a valid yield is becoming more important as statements of sustainability are increasingly required; however, in many cases the ideal data on growth rates, mortality and recruitment are not available. This may be especially true in the preparation of community management plans.

Progress with the system has been good and the model MYRLIN (Methods of Yield Regulation in Moist Tropical Forest with Minimal Data) is now well developed. A training workshop was held in Oxford in September 2001 for those who had attended the 1999 CATIE meeting. In cooperation with another DFID (FRP) project based in Edinburgh, which has constructed an individual tree model for dipterocarp forests in Indonesia (SYMFOR), an exit strategy was developed which will compare both approaches for situations in Indonesia and Guyana. This project extension will also involve training periods in the use of both systems for counterpart staff in the respective countries.

## Cultural Ecology

**Academic staff:** Mr P.J. Stewart

Mr Stewart has written invited chapters for two books: one on ecological morality and the other on religion and agriculture, both books are due for publication in 2002. In addition he has been asked to revise his book "Unfolding Islam" in the wake of September 11th.

# EDUCATION

## BA in *Biological Sciences*

The Biological Sciences degree offers a wide choice of options embracing both pure and applied aspects of biology. Candidates take a first year Honour Moderations with courses focussing on cells and genes, organisms and population biology. This provides a broad overview of biology and prepares them for more specialized courses in the second and third years when students specialize to an increasing degree. In addition to courses in evolution and systematics and quantitative methods, they may also choose to follow options in:-

Animal biology
Plant and microbial biology
Environmental biology
Cell and developmental biology
The biology of animal and plant disease

Institute staff contribute to most of these options including complete lecture courses in silviculture, tree breeding, forest conservation and forestry for timber production within the environmental biology option.

## MSc in *Forestry and its Relation to Land Use / Forestry: Science, Policy and Management*

The Institute's one-year taught MSc, now in its 29th year, continues to be highly regarded. Its name was changed to "*Forestry: Science, Policy and Management*" in 2000 to reflect its content better. Major elements of the course are some 20 series of lectures and seminars, an extended essay, a forest management exercise, and a dissertation. Substantial contributions from many visitors and Institute staff who do not have formal University teaching responsibilities ensure that the course maintains its breadth, depth and close contact with research, and that the wide range of students' interests (typified, for example, by the variety of dissertation topics listed) can be addressed satisfactorily. One of the teaching strengths of the OFI is the recent first-hand experience that so many staff have of conditions in other countries, especially in the tropics.

Fourteen students were admitted to the 2001/2002 class. As in previous years, one of the values of the class is the diversity of its membership, in terms of both the subject of first degree and subsequent experience. Half of the students are British, most with first degrees in biological/environmental sciences. Those from overseas come from Cyprus, Denmark, India, Indonesia, Uganda and USA.

The Department for International Development (DFID) and the Ernest Cook Trust were the major sources of financial support for British students following the course. Other funders were the Worshipful Company of Builders Merchants, the Wills Trust, the Michael Jourdain TFT Scholarship and the Dan Kemp Scholarship. The Hosier Fund and Norman & Ivy Lloyd Scholarship, both associated with Linacre College, were also contributors.

### 2000-2001 class

The dissertations submitted were entitled:-

Mr Franz-Eugen Arnold
*Implications of genetics for silviculture and management of mahoganies.*

Ms Rose Bell
*Susceptibility of selected agroforestry species to the root knot namatode* Meloidogyne javanica.

Mr Cameron Campbell
*The cultivated wilderness. An exploration of the notions of wilderness, ecological restoration and re-wilding in the context of new native woodland creation.*

Mr Stephan Gale
*From taxonomy to agroforestry: elaborating botanical keys for use by farmers and extension workers. Case study of* Lysiloma (Leguminosae: Mimosoideae) *in Mesoamerica.*

Mr Tobias Jackson
*Assessment of bioquality in coffee plantations in the neotropics.*

Ms Tonya Lander
*Beech seedling mycorrhizae: preferential colonization of seedlings and ecological factors that may play a role.*

Mr Weston Mwase
*Ash* (Fraxinus excelsior) *family variations in growth and form characteristics in a breeding seedling orchard.*

Mr Antwi Oduro
*An investigation into the effect of plot size and shape on the efficiency of a woodland inventory.*

Mr Koki Okawa
*Economies of scale in the Japanese sawmilling industry - the survivor technique analysis.*

Ms Caroline Pridham
*The opportunities and constraints of monitoring and evaluating community forestry projects in sub-Saharan Africa.*

Mr Timothy Rayden

*Making conservation pay: private sector forestry and the wise use of natural resources.*

Mr Vishnu Sharma
*Socio-economics and sustainable development of non-timber forest products in India: an analysis with special reference to the State of Himachal Pradesh.*

Mr Belmond Tchoumba
*Participatory forest inventory: what role can it play in sustainable forest management? With special reference to Cameroon.*

Mr Stephen Teo
*A gap analysis of plant biodiversity for potential conservation in north west Borneo (Sarawak).*

Mr Pelis Vatnabar
*Stakeholders' governance, conservation and development of forest resources in Papua New Guinea.*

Mr Ben Vickers
*The ecology and management of* Spermadictyon suaveolens *(Roxb.). A locally important but little studied fodder tree from central Nepal.*

Mr Alistair Yeomans
*Environmental factors and site productivity of Douglas fir* [(Pseudotsuga menziesii) *(Mirb.) Franco] plantations in Portugal.*

### The Jubilee Prize

This prize was awarded to Mr Cameron Campbell (Green College).

### The Director's Prize for the Best Dissertation

This prize was awarded to Mr Stephan Gale (Linacre College).

### 2001-2002 class

Mr Fred Babweteera
*Forestry, Makerere, Uganda*

Ms Jane Bryden
*Geography, Cambridge*

Mr Nick Dowling
*Countryside Management, Wye, London*

Ms Clare Ferguson
*Biological Science, Sheffield*

Ms Sarah Gillett
*Biological Science, Birmingham*

Mr Eric Hypolite
*Forestry, Cyprus Forestry College, Cyprus*

Mr Pawan Kamar
*Forestry, GB Pant, India*

Ms Rebecca Latchford
*Tropical Environmental Science, Aberdeen*

Ms Mary Menton
*Environmental Science, North Carolina, USA*

Ms Somereet Nijjer
*Biology, Rice University, USA*

Ms Helen Porter
*Archaeology, London*

Ruslandi
*Forest Management, Gadjah Mada, Indonesia*

Mr Flemming Sehested
*Natural Resource Management, Danish Forestry College*

Mr Richard Snow
*Philosophy, Bristol*

## Research Students

Twelve of the research students registered in the Department of Plant Sciences in 2001 were working within the Institute; their work is described in earlier sections of this report. Three students, Matthew Markopoulos, Angela Collins and Lisa Newman successfully defended their doctoral theses and one student, Tom Evans, has submitted his doctoral thesis and will be defending it early in 2002.

## Further Information on Education

Further information about the OFI's educational activities is available from Dr Peter Savill for undergraduate and postgraduate taught and research degrees, and Mrs Jackie Grant for non-degree courses and programmes.

# RESEARCH SUPPORT, LIBRARY AND INFORMATION SERVICES

## Herbarium and Xylarium

**Academic staff:** Dr S.A. Harris
**Technical staff:** Mr I.D. Gourlay
Miss S.K. Marner
Mrs A.M. Strugnell

Oxford University Herbaria has occupied its current site in the Department of Plant Sciences for nearly 50 years and now comprises some 800,000 specimens. However, the space problems had become severe, cupboards were overfull and boxes of specimens covered almost all available surfaces or were secreted away in other parts of the Department of Plant Sciences. Thus, there were three significant problems; storage conditions for the collections were not ideal, space to work on the collections was very limited and no space was available for the collections to expand. However, after six years of persistent work on the parts of Professor Christopher Leaver and Dr Stephen Harris, funding for refurbishment of Oxford University Herbaria (FHO) has been secured from Gatsby Charitable Foundation and Science Research Infrastructure Fund (SRIF).

Refurbishment of the collections will take place in two phases. Refurbishment of FHO is almost complete and the refurbishment of OXF will occur over Summer 2002. The principles that have guided the refurbishment of FHO are care and access to the collections, space for researchers to work and space to expand the collections.

Specimens in FHO will be stored on rolling stack in Kew-style green boxes, thus generating space for additional specimens and creating research space for our own staff and students and visitors. The vision of FHO at the end of refurbishment is simple, but the implementation was another matter. The biggest problem that was faced was the amount of material to be moved, approximately 250,000 herbarium specimens and associated spirit and carpological collections. Over about a month, nearly 37 tonnes of material were decanted from the herbarium.

Once empty, gutting FHO was done rapidly; the cedar wood cabinets, yielding easily to sledge hammer and crowbar, before the remnants were discarded through a window into a skip. Fifty years of dust were disturbed and specimens that had slipped behind cupboards were found. The floor was strengthened and rolling stacks were installed. It will take time to get things back into order but once this is done, for the first time in nearly 40 years the whole of FHO will be in one place and a single sequence, rather than scattered around the Department of Plant Sciences.

I would like to express publicly my thanks to Alison Strugnell, Ruth Eastwood and Ian Gourlay for their Herculean efforts in emptying FHO of its contents in just over a month. Many thanks also to all those people in the Department of Plant Sciences who helped unload the lorry loads of green boxes when they arrived.

## Oxford Forest Information Service

**Librarian & Information Service Manager:** Mr R.A. Mills
**Special Collections Librarian/Archivist:** Mrs A.M. Townsend
**Reader Services Librarian:** Ms J.B. Pinfold
**Senior Library Assistant:** Mrs C.H. Jenkins
**Library Assistant:** Ms Y. Kondrashova
**Trainee Librarian:** Mr J.C. Butterworth

The Library's first full year of operation under the management of Oxford University Library Services (OULS) marked the beginning of a new phase in the provision of library services to the OFI. Three new staff were appointed and job descriptions re-evaluated for all staff. This allowed the resumption of 'normal service' and, in contrast to the two previous years, the library remained open to all throughout the summer vacation. Backlogs in acquisitions and cataloguing had been largely eliminated by the end of the year. The floor area of the library was slightly reduced by the transfer of two rooms back to the Department of Plant Sciences, as stipulated in the transfer agreement, but by judicious re-arrangement no change in user access to materials was required.

In September, OULS signed a new five-year agreement with CAB International. This was marked by a formal ceremony and dinner, and the issue of a university press release (*'New chapter in library collaboration'*, http://www.admin.ox.ac.uk/po/010831.shtml). The new Agreement allows for the continuation of all existing activities and for expansion into new areas of collaboration, including database development, training, consultancy and digitization. This last topic is the first to be addressed, with the formulation of proposals for an *Oxford Digital Library for Forestry*. As part of the new OULS *Oxford Digital Library* (http://www.odl.ox.ac.uk), this would provide online full-text access to materials in the Oxford collections not hitherto available electronically, linked to the corresponding CAB abstracts. It is hoped that the first stage of this project will begin in 2002, and include a variety of materials - paper, microfilm, and wood samples from the Xylarium - by way

of a pilot test. Once established, the digitization programme would be ongoing, taking the place of the Library's longstanding microfilm service. Suggestions for materials to be included are welcome.

The information service has be re-christened *'Oxford Forest Information Service'* to mark the new arrangements, in line with the *Global Forest Information Service* (GFIS) to which both the University and CABI have affirmed their commitment. GFIS itself continued to develop during the year, becoming a Special Programme of IUFRO in September, and thereby acquiring permanent status and a full-time paid co-ordinator. The GFIS Task Force met at FAO, Rome, in February and in Portland, Oregon, in August, and there held a joint session with the newly-reconstituted IUFRO Unit 6.03, *Information services and knowledge organization*, which increased the librarian presence on the Task Force by an impressive 80%! Tasks for the Unit include the compilation of a new on-line world directory of libraries and information services dealing with forest-related subjects; the last such directory was compiled by USDA in the early 1980s and is now well out of date. As in our own case, forestry libraries have often been subsumed in larger collections and it is important to identify where those collections are and to build appropriate support networks so that subject expertise does not disappear over time and collaborative collection development can be facilitated. To this end, 6.03 is also promoting the newly-created FORELISE group - Forestry Libraries and Information Centres in Europe - which Oxford is leading and will in due course, we hope, help to ensure the long-term viability of Europe's rich but diverse and scattered forestry collections and the development of cost-effective European electronic information services, as part of GFIS.

Terminological issues are central to the implementation of GFIS, and new proposals for the development of an '*Agricultural Ontology Service* (AOS)' by a consortium which might include CABI, FAO, BIOSIS and the US National Agricultural Library amongst others, were being developed in the course of the year. For forestry this would provide a global synthesis of work begun at Oxford in the 1930s, from which sprang the *Oxford Decimal Classification for Forestry*, once widely used but now long out of date, and create a new tool for both machine and manual indexing. To assist in its development, Oxford's unique collection of multilingual forestry terminologies is proposed for inclusion in the *Oxford Digital Library for Forestry*.

Contributions to the BIOME life sciences 'hub' of the UK Resource Discovery Network continued; Oxford co-ordinates the AgriFor (Agriculture, Forestry and Food) gateway and contributes to the Natural Selection (botany, ecology, zoology etc) gateway which is co-ordinated by the Natural History Museum, London. Use of BIOME (http://biome.ac.uk)continues to grow apace with over 1 million pages now served per month, and the hub currently contains over 13,000 descriptions of quality-assessed internet resources. Work is in progress on updating the 'Virtual Library for Forestry' compiled by the Finnish Forestry Research Institute, METLA, and incorporating it into BIOME. A special 'Forestry' interface to BIOME is planned for implementation in summer 2002; it will offer direct links to all the services mentioned above.

Considerable strides have been made in information skills training programmes, with over 30 hands-on sessions on various topics being offered to university students and staff. Nationally, CABI authored a very successful internet tutorial *'Internet for agriculture, food and forestry'*, hosted by BIOME for the RDN's Virtual Training Suite (http://agrifor.ac.uk/vts/agrifor).

The project proposal submitted to the British Library for a *'Clearing House for Information in Plant Sciences'* (CHIPS) was unfortunately not successful, but the partners are continuing to explore ways in which closer collaboration can be mutually beneficial, and new proposals are in development.

New arrangements for the sale of OFI Publications were put in place with the signing of a distribution agreement with NHBS Ltd, based in Totnes, Devon. All in-print OFI publications are now listed and can be purchased online from NHBS on http://www.nhbs.com/services/oxforest.html. Over-the-counter sales are still available in the Library, as are microfilm sales of out-of-print publications.

Towards the end of the year, a survey was conducted to establish users' reactions to the new management arrangements. These were overwhelmingly positive, with not a single negative comment received from any of the seven categories of users identified: undergraduates, taught MSc students, postgraduate research students, contract research staff, academic staff, herbarium and library staff, and external users. This very encouraging result reflects a clear confidence in the long-term security of the forestry collections as part of Oxford University Library Services, and an expectation of continued growth of the world-wide information services developed over the last sixty years. The initiatives implemented in the past year demonstrate our commitment to achieving that growth in collaboration with partners old and new.

# INSPIRE: Species Information Database

**Support staff:** Mrs J.P. Smith

## INSPIRE (INteractive SPecies Information REtrieval)

INSPIRE is a computer-based storage and retrieval system for the characteristics, preferences and known potential of tree species. The programme was developed to assist foresters in choosing species suitable for tropical and sub-tropical plantations. It comprises information on species under 21 headings which fall into the following categories:-

Climate preferences;
Soil preferences;
Silviculture;
Production potential;
Protection planting;
Timber density; and
Utilization.

The INSPIRE package is available for any IBM-compatible microcomputer. The OFI publication *Tropical Forestry Papers No.15* contains further information not included in the computer system and serves as a reference manual. It incorporates data on taxonomy, natural occurrence, timber features, nursery requirements and principal pests and diseases, and also includes references for each species. This publication is now out of print but is available in photocopied form from the OFI library.

OFI staff assisted CABI staff in preparing bids for financial support for the CD-ROM compendium on over 650 species that subsumed and updated INSPIRE. Several staff contributed items on selected species for the compendium.

# BRAHMS: Taxonomic Information System

**Project Manager:** Mr D.L. Filer

## BRAHMS (Botanical Research And Herbarium Management System)

BRAHMS is database software for botanical research and herbarium management. For the latest developments and system downloads, go to http://www.brahmsonline.com. During 2001, the continued development of BRAHMS has been one component of the extensive modernization of the Oxford herbaria. In addition to the extension of curation services, there has been a substantial development of research support tools including the addition of modules to manage DNA samples and sequences. Within this Department, the Hughes work on *Lupinus* is steering BRAHMS into new areas of practical support for monography while the preparation of the checklist of Mount Mulanje by Strugnell has pushed forward developments with text storage and formatting. Andrew Liddell has re-developed the BRAHMS web site and Jonathan Bennett is coordinating the preparation of the BRAHMS 5 manual.

**Key developments – 2001**

New software developments are posted on the web site in the Software Development section. They include the addition of the Map Library, Image Library and DNA sequence modules; upgraded transactions module for loans and exchanges; optional-use data forms added to key data screens including the main collection file; increased flexibility with linked data files allowing users to attach linked data files with any fields to a core BRAHMS database; custom lookups that generate lookup dictionaries for non-standard fields; extensive enhancements to RDE and RDE importing; password encryption; extended calculate and data analysis options throughout; and a new auto-upgrade feature that means you can download the new version from the web and rapidly auto-upgrade your databases.

**Active projects – 2001**

The BRAHMS Project started in 1985. Since then, the software has worked its way through five principal revisions. It is now assisting herbaria in Europe (Baltic states, Germany, Netherlands, Portugal and the UK); Africa (Benin, Cameroon, Gabon, Ghana, Kenya); Asia (Bangladesh, Indonesia, Malaya, Sabah, Sarawak, Singapore) and the Americas (Brazil, Honduras, Panama, Puerto Rico, USA). The first external project was started at the Paul C. Standley herbarium (EAP), Honduras in 1989. The largest database to date is in the Netherlands where the Leiden, Utrecht and Wageningen databases have been growing since about 1995.

Regional data networks are being established in Brazil and the Netherlands and, with assistance from the Asia IT&C European Community Initiative, the web based project 'South East Asian Botanical Collection Information Network (SEABCIN)' will assist with data exchange between herbaria in Europe and South East Asia.

In addition to these herbarium-based curation projects, the development of the more research oriented components of BRAHMS is driven forward by those using BRAHMS to prepare monographs, check-lists, floristic summaries and related products.

# PROSPECT: The Wood Database

**Support staff:** Mrs J.P. Smith

## PROSPECT (Programmed Retrieval Of Species by the Property and End-use Classification of their Timbers)

PROSPECT is a computer database designed to provide information on timber species from all areas of the world which has been developed at the Oxford Forestry Institute over the past 20 years.

For each species the database records taxonomic and distribution details, as well as data on 92 timber properties and 175 end uses, originating from over 1,800 published sources. For each property or end use, up to 20 different sources may be quoted, ensuring any variation in opinion is reflected on screen - essential when dealing with a naturally variable material, where the variation within can be as great as that between species. The majority of data items are linked to their reference sources throughout.

For most of the 1,552 species recorded, a scanned wood surface image is displayed and more than 28,000 common and trade names are included to aid species identification.

PROSPECT has a simple interface using toolbars, check boxes and pull-down menus. A number of methods are provided to search for data based on geographical distribution, taxonomy, wood properties, end-uses and references. More complex searches using multiple properties can be used to evaluate and identify potentially useful species, optionally related to a specific product, or conversely, to evaluate potential end-uses for a particular species. Direct comparisons may also be made between specific properties of any two species.

PROSPECT represents a significant advance in authoritative data provision and evaluation, encouraging the efficient and sustainable utilization of the world's timber resource.

The latest version of PROSPECT (version 2.1 for Windows) is available to purchase on CD-ROM. Further information can be obtained from the OFI and is also accessible at our Web site at http://www.plants.ox.ac.uk/ofi/prospect or by e-mail at prospect@plants.ox.ac.uk. A fully working free sample CD-ROM with data for 20 species is available on request or can be downloaded from our web site.

CABI is taking the lead in a bid to the International Tropical Timber Organization for financial support to facilitate the merger of PROSPECT with CABI's Tree Compendium.

# EXTERNAL ACTIVITIES - INSTITUTIONAL

## British Council Higher Education Link Scheme

**Coordinator:** Prof J. Burley
**Consultants:** Dr P.A. Huxley , Ms V. Smith, Dr R. Mathews, Dr S. Christophe, Dr J. Chamberlain

### Link Project with University of Nairobi

Activities under the link agreement continued to focus on the preparation of proposals for a research project on farmers' coping strategies for environmental change within the Lake Victoria Basin in Kenya, Tanzania and Uganda. Staff and consultants of Oxford and Nairobi universities completed exchange visits and agreed that the proposed project would be too large for the European Commission programme. It was agreed to revise and restructure it and to organize a meeting with all the collaborators and a number of potential donors early in 2002.

## Tropical Forest Resource Group

**Chairman:** Professor J. Burley
**Secretary:** Dr P.S. Bacon / Mr A.J. Pottinger
**Assistant:** Ms N. Baker

A significant event during the year was the transfer of the Secretariat from Green College to the Naturebureau in Newbury (http://www.tfrg.co.uk), and the Secretaryship from Dr Bacon to Mr Pottinger. One training course was completed during the year and a number of project bidding opportunities were tracked. The major success was the bid for forest research and eduction support in India to be led by TATA Consulting, Delhi. Two new members were elected - Forestry Research (South) and TRADA International.

### Community Forestry Education Project in South Africa

This project terminated successfully during the year. The Project Manager, Dr Isla Grundy, returned to Oxford to complete reports and publications. The project was considered by DFID and Stellenbosch University to have met its objectives and successfully supported the University in developing its capacity for rural development forestry.

### Current Methods in Tropical Forestry

This was the 5th year that this course has been run and included the following participants:-

Mr Etigale Bassey
Mr Patrick Njar
Mr Bassey Effiong
Mr Ojah Amang Egbai
Ms Bridget Owuri Nkor
Ms Mary Jane Ebri

These were all from the Cross River State Forest Department and were funded by DFID via its community forestry project in Cross River State, Nigeria. The course was managed out of Green College and followed the established form, including inputs from all the member organizations of the TFRG as well as a tour to forestry institutes in Germany and Belgium.

# STAFF PUBLICATIONS

Bhagwat, S., Brown, N., Evans, T., Jennings, S. and Savill, P. (2001) Parks and factors in their success. Science 293: 1045-1046.

Bass, S., Thornber, K., Markopoulos, M., Roberts, S. and Grieg-Gran, M. (2001) Certification's impacts on forests, stakeholders and supply chains. IIED, London.

Brown, N. (2001) Hot whodunit leaves you cold. (Review of Australian Rainforests: Islands of Green in a Land of Fire by D.M.J.S. Bowman.) Times Educational Supplement, 30 November 2001.

Brown, N. (2001) Twelve entries in Encyclopædic Dictionary of Environmental Change. (Edited by Matthews, J.A., Bridges, E.M., Caseldine, C.J., Luckman, A.J., Owen, G., Perry, A.H., Shakesby, R.A., Walsh, R.P.D., Whittaker, R.J. and Willis, K.J.) Edward Arnold.

Burley, J. (2001) Women in forestry and forest research. International Forestry Review 3(1): 64-68.

Burley, J., Seppälä, R., El-Lakany, H., Sayer, J., Krott, M. (2001) Voicing interests and concerns: challenges for forest research. Forest Policy and Economics, Vol.2, Issue 1, 79-88.

Chamberlain, J.R. (Ed.) (2001) *Calliandra calothyrsus*. An agroforestry tree for the humid tropics. Oxford Forestry Institute Tropical Forestry Papers No.40. Oxford Forestry Institute, Oxford, UK, 100pp.

Jennings, S.B., Brown, N.D., Whitmore, T.C. and Boshier, D.H. (2001) Ecology provides a pragmatic solution to the maintenance of genetic diversity in sustainably managed tropical rain forests. Forest Ecology and Management 154(1-2): 1-10.

Mountford, E.P., Backmeroff, C.E. and Peterken, G.F. (2001) Long-term patterns of growth, mortality, regeneration and natural disturbance in Wistman's Wood, a high altitude oakwood on Dartmoor. Report of the Transactions of the Devonshire Association for the Advancement of Science 133, 231-266.

Pryor, S. (2001) Afforestation in Britain: Opportunities and obstacles, strategies and targets. In: NEWFOR: New forests in Europe. Edited by N. Weber. Eur Forest Inst Proc. No 35, 77-88.

Pryor, S.N. and Peterken, G.F. (2001) Protected forest areas in the UK. WWF / Forestry Commission.

Robinson, J., Harris, S. A. and Juniper, B. J. (2001) Taxonomy of the genus *Malus* Mill. (Rosaceae) with emphasis on the cultivated apple, *Malus domestica* Borkh. Plant Systematics and Evolution. 226: 35-58.

Strauss, S.S., Coventry, P., Campbell, M.M., Pryor, S.N. and Burley, J. (2001) Certification of genetically modified forest plantations. International Forestry Review 3(2): 87-104.

Strauss, S.S., Campbell, M.M., Pryor, S.N., Coventry, P. and Burley, J. (2001) Plantation certification and genetic engineering: FSC's ban on research is counterproductive. Journal of Forestry, Vol.99, No.12, December 2001.

# OFI PUBLICATIONS CATALOGUE

***O.F.I. OCCASIONAL PAPERS***
*[Issues 1-29 published as C.F.I. OCCASIONAL PAPERS]*
*ISSN 0141-8181*

*OP1.* A long-term surveillance system for British woodland vegetation, by H.C. Dawkins and D.R.B. Field. 1978. *ISBN 0 85074 038 X £7.50*

*OP2.* Site index curves for *Gmelina arborea* Roxb., by A. Greaves. 1978. *ISBN 0 85074 043 6* ***Very limited stocks*** *£2.50*

*OP3.* A regional volume table for *Gmelina arborea* Roxb., by A. Greaves. 1978. *ISBN 0 85074 044 4* ***Very limited stocks*** *£3.00*

*OP4.* Some wood properties of *Pinus patula* (Schiede and Deppe) from Uganda and techniques developed in studying them, by R.A. Plumptre. 1978. *ISBN 0 85074 032 0* ***Very limited stocks*** *£5.50*

*OP5.* Wood density variation in plantation-grown *Pinus patula* from the Viphya plateau, Malawi, by P.G. Adlard, C. Goodwin-Bailey and S. Austin. 1979. *ISBN 0 85074 045 2 £3.00*

*OP6.* Pulp and wood densitometric properties of *Pinus caribaea* from Fiji, by J. Burley and E.R. Palmer. 1979. *ISBN 0 85074 046 0 £5.50*

*OP7.* Stand density and stem taper in *Pinus patula* Schiede and Deppe, by P.G. Adlard and K.F. Richardson. 1979. *ISBN 0 85074 047 9* ***Very limited stocks*** *£2.50*

*OP8.* Growing stock levels and productivity conclusions from thinning and spacing trials in young *Pinus patula* stands in Southern Tanzania, by P.G. Adlard. 1980. *ISBN 0 85074 048 7* ***Microfilm only*** *£3.00*

*OP9. Pericopsis elata* (Afrormosia), by P. Howland. 1979. *ISBN 0 85074 049 5* ***Limited stocks*** *£3.00*

*OP10.* Tropical rain forest silviculture: a research project report, by T.J. Synnott. 1980. *ISBN 0 85074 050 9* ***Microfilm only*** *£4.50*

*OP11.* An annotated bibliography of *Gilpinia hercyniae* (Hartig), European spruce sawfly, by P.H.W. Adams and P.F. Entwistle. 1981. *ISBN 0 85074 051 7 £4.00*

*OP12.* Review of *Pinus patula* Mor. and *P. oocarpa* Schiede international provenance trials, by A. Greaves. 1980. *ISBN 0 85074 052 5* ***Microfilm only*** *£6.50*

*OP13.* A second look at *Agathis*, by M.R. Bowen and T.C. Whitmore. 1980. *ISBN 0 85074 053 3* ***Microfilm only*** *£3.00*

*OP14.* Growth and growing space, by P.G. Adlard & J.P. Smith. 1981. *ISBN 0 85074 054 1* ***Microfilm only*** *£4.50*

*OP15.* Vegetative propagation of trees in the 1980's, by K.A. Longman. 1980. *ISBN 0 85074 055 X* ***Microfilm only*** *£3.50*

*OP16.* Problems and opportunities in tropical rain-forest management, by P.E. Neil. 1981. *ISBN 0 85074 060 6* ***Microfilm only*** *£11.00*

*OP17.* Fire control in tropical pine forests, by A. Wolffsohn. 1981. *ISBN 0 85074 056 8* ***Microfilm only*** *£7.00*

*OP18.* The adoption of agricultural practices for the development of heritable resistance to pests and pathogens in forest crops, by I.A.S. Gibson, J. Burley and M.R. Speight. 1980. *ISBN 0 85074 057 6* ***Limited stocks*** *£3.50*

*OP19.* An economic analysis of silvicultural options for broadleaved woodlands. 1982. Volume I, by S.N. Pryor. *ISBN 0 85074 041 X £8.50* Volume II, by R. Lorraine-Smith. *ISBN 0 85074 042 8 £8.50*

*OP20.* Planning, performance and evaluation of growth and yield studies : proceedings of the meeting of IUFRO Subject Group S4.01, Oxford, September 1979, edited by H.L Wright. 1983. *ISBN 0 85074 062 2* ***Microfilm only*** *£11.00*

*OP21.* HP67 and HP97 calculator programs for elementary statistical calculations (also compatible with the HP41-C), by T.J. Wormald. 1982. *ISBN 0 85074 037 1* ***Very limited stocks*** *£8.00*
Set of magnetic cards for above, available to special order *£36.00*

*OP22.* A method of selecting agricultural land from production and conversion forests in Indonesia, by M.S. Ross. 1983. *ISBN 0 85074 063 0 £6.50*

*OP23.* Firewood versus alternatives: domestic fuel in Mexico, by Margaret I. Evans. 1984. *ISBN 0 85074 071 7* ***Limited stocks*** *£6.00*

*OP24.* Ash dieback survey, by R.G. Pawsey. 1983. *ISBN 0 85074 072 X* ***Very limited stocks*** *£6.00*

*OP25.* First observations of ecological surveillance plots on afforested open-cast spoil in South Wales, by H.C. Dawkins with R.L. Hockin and J.D. Power. 1985. *ISBN 0 85074 082 7 £5.50*

*OP26.* A versatile, low-cost drying kiln for opening pine cones, by A.M.J. Robbins. 1985. *ISBN 0 85074 083 5* ***Limited stocks*** *£5.50*

*OP27.* A checklist of the flora of Budongo forest reserve, Uganda, with notes on ecology and phenology, by T.J. Synnott. 1985. *ISBN 0 85074 085 1 £7.00*

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