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LIST OF ACRONYMS AND ABBREVIATIONS

AGRIS - International Information System for the Agricultural Sciences and Technology
AGROVOC - Multilingual Agricultural Thesaurus
ATROFI-UK - **A**rchive of **Tro**pical **F**orestry **I**nformation
BBSRC - Biotechnology and Biological Sciences Research Council
BIOME - The Medical, Health and Life Sciences Hub of the Resource Discovery Network
B.P. - Before present
BRAHMS - **B**otanical **R**esearch **A**nd **H**erbarium **M**anagement **S**ystem
CABI - CAB International
CABICODES - a classification scheme used to define subject categories in the CAB Abstracts database
CARIS - Current Agricultural Research Information System
CARPE - Central African Regional Programme for the Environment
CATIE - Centro Agronomico Tropical de Investigacion y Enzeñanza
cd - Crown diameter
CD-ROM - Compact disc read-only memory
CHIPS - Clearing House for Information in Plant Sciences
CIAT - Centro Internacional de Agricultura Tropical
COAIM - Consultation on Agricultural Information Management
COI - University of Coimbra, Portuguese herbaria
dbh - diameter at breast height
DFID - Department for International Development
DPhil - Doctor of Philosophy
EU - European Union
FAO - Food and Agriculture Organization of the United Nations
FHO - The Oxford University Daubeny Herbarium
FHOw - The Oxford Forestry Institute Xylarium
FORELISE - Forestry Libraries and Information Services in Europe
FRIM - Forest Research Institute of Malaysia
FRP - Forestry Research Programme (of DFID's Renewable Natural Resources Programme)
GFIS - Global Forest Information System
GM - Genetic modification
GPS - Global positioning system
ha - hectare
HAMAB - Herbarium in Macapá, Amapá
HTTP - Hypertext transfer protocol
IAN - Instituto Agronomico do Norte
IIED - International Institute for Environment and Development
INF - Irati National Forest
INPA - Instituto Nacional de Pesquisas da Amazonia
INSPIRE - **IN**teractive **SP**ecies Information **RE**trieval
IPSIS - Invasive Plant Species Information System
ISSN - International standard serial number
ITTO - International Tropical Timber Organization
IUCN - World Conservation Union
IPNI - International Plant Names Index
IUFRO - International Union of Forestry Research Organizations
KEP - Kepong Herbarium, Malaysia
L - Leiden Herbarium, The Netherlands
LISC - Centro de Botânica, Portuguese herbiara
MAPR - Mayagüez Herbarium, University of Puerto Rico
MG - Museu Paraense Emîlio Goeldi - Herbarium in Belem, Para, Brazil
MSc - Master of Science
NERC - Natural Environment Research Council
NGO - Non governmental organization
NHM - National Herbarium of the Netherlands
OFI - Oxford Forestry Institute
OULS - Oxford University Library Services
OXF - The Oxford University Fielding-Druce Herbarium
PAWS - Plantations on ancient woodland sites
PCA - Principal component analysis
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
RDF - Resource Description Framework
SAN - Sandakan Herbarium, Malaysia
SAR - Sarawak Herbarium, Malaysia
SCRI - Scottish Crops Research Institute
SGS - Société Générale de Surveillance
SISTEM+ - **S**pecies **I**nformation, **S**eed, **T**rials and **E**nvironment data **M**anagement
SSSI - Site of special scientific interest
SUDAM - Superintendência do Desenvolvimento da Amazônia
TFP - Tropical Forestry Papers
TFRG - Tropical Forest Resource Group
TREE CABWeb - service providing Internet access to the three CABI forestry journals
U - Utrecht Herbarium, The Netherlands
UK - United Kingdom
URL - Universal resource locator for Internet
USA - United States of America
USAID - United States Agency for International Development
VLF - Virtual Library for Forestry
WAG - Wageningen Herbarium, The Netherlands
WWF - World Wildlife Fund
WWW - World Wide Web

HIGHLIGHTS

For the first time since the creation of the Institute in 1924, there will be no formal paper version of the Annual Report; in keeping with current technological trends the report will be available on the Institute's Web site from which all or part of it can be downloaded. As always the bulk of the Institute's research will continue to be published in peer-reviewed journals, books, Institute publications and agency reports.

The Institute congratulated Dr Colin Hughes on his election to a Royal Society Fellowship within the Department of Plant Sciences; he will continue as an Associate Member of the OFI. We also congratulated Dr David Boshier on the publication of his book (co-edited by A Young and T J Boyle) "*Forest conservation genetics: principles and practice*".

Staff of the Institute continued to contribute significantly to the teaching, management and examination of the undergraduate Biology degree. The major highlights concerned the MSc course; a total of 18 students attended the courses starting and finishing within the calendar year, one of whom split his course over the two years. The course beginning in October was substantially restructured into a modular form that permits greater depth and intensity of study of the major components while maintaining the breadth of coverage. The Natural Environment Research Council decided not to fund further scholarships for the course beginning in October 2000 (after 20 years in which 3-4 scholarships had been provided annually); however, this loss was partially offset by generous contributions towards scholarships from the Barbinder Trust, the Commonwealth Forestry Association, the DFID Shared Scholarship Scheme, Linacre College (Hosier Fund and Lloyd Studentship), Queen's College, the Worshipful Company of Builders Merchants and the Tropical Forest Trust (the latter for "The Michael Jourdain TFT Scholarship").

Staff of the Institute collaborated with staff of other Member Institutions in the Tropical Forest Resource Group to finalize the Community Forestry Education Project in South Africa and to continue the academic link project with the University of Nairobi; this latter is intended to prepare major proposals to the European Union and to other donor agencies for strengthening the roles of east African universities in research, teaching and extension support for the Lake Victorian Basin development programme.

The Vice-Chancellor and several senior staff members of the Universiti Malaysia Sabah visited the University to discuss collaboration in research and teaching in both engineering and forestry. A Memorandum of Understanding is in preparation and hopefully this will lead to joint research and teaching with this important new university campus in Malaysia.

The report and recommendations of the External Review of Forestry carried out in 1999 were discussed and accepted by the University. The Plant Sciences Library and Forestry Information Service were transferred to the management of the Central University Library System and the contract with CAB International for the joint acquisition, abstracting and distribution of the world's forest literature is being renegotiated by the Director of Library Services. This should ensure the continuity of the library and information services.

Another major recommendation of the Review was also pursued, namely the appointment of new lecturers in plant ecology and forest policy. Advertisements were placed in December, interviews will be in April 2001 and hopefully suitable incumbents will be in post by October 2001.

For myself the major event of the year outside the Institute was the highly successful 21st IUFRO World Congress in Malaysia during August. Over 2,000 delegates from 96 countries, including 169 from 38 developing countries, enjoyed five keynote plenary addresses, 88 papers in sub-plenary sessions and 500 papers in 125 group sessions; in addition 500 posters were displayed. The Congress was the last major event in my five year period as President of IUFRO. All my papers and speeches presented in the period are being compiled in one volume including 26 conference papers, 19 welcome and closing speeches, 14 IUFRO News articles, 5 annual report prefaces and 12 congratulatory messages to member institutions; none of these appear in OFI Annual Reports or in Departmental submissions to Government reviews. As Past-President for the next five years my role will be to provide continuity particularly in linkages with international agencies.

I record with great sorrow the deaths of Mike Croggon (a research student), Margaret Beak (former employee of the Commonwealth Forestry Bureau and wife of the former Director of the CFB, Percy Beak) and Dr Darrell Posey (well known anthropologist and Associate Member of the Institute, who died as this report was being prepared in early 2001).

As always I wish to thank all the members of staff of the Institute for their continued dedication to their research and/or teaching; further details of their individual activities appear in this Annual Report.

Professor Jeffery Burley
Director

OXFORD FORESTRY INSTITUTE

Department of Plant Sciences, University of Oxford

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RESEARCH

Ecology and Silviculture

Academic staff: Dr N.D. Brown, Dr P.S. Savill
Post doctoral research: Dr J.D. Hubert, Dr S.B. Jennings
Research assistant: Mr T.J. Clements, Mr E.P. Mountford, Ms K. Plenderleith
Technical staff: Miss A. Sing
Research students: Ms T. Alves, Miss C.J. Bampfylde, Mr D. Bebber, 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.

The assessment of the performance of Douglas fir stands in Portugal was carried out through the modelling of dominant height using nine growth models. Based on statistical and biological criteria a McDill-Amateis model was used to construct site index curves based on data from 20 permanent sample plots and 87 stem analysis trees.

In the Spring of 2000 a provenance trial was established with Portuguese, US and Canadian provenances. The genetic diversity of Portuguese provenances has been assessed through isozyme analysis of 300 trees from 10 stands. US and Canadian seeds of Douglas fir were used in the isozyme study in an attempt to determine regions where the current Portuguese provenances originate. An analysis of the results has still to be undertaken.

A study of site factors and Douglas fir growth will be carried out to predict the potential area suitable for Douglas fir establishment in Portugal, using GIS. The main site factors and their ranges for Douglas fir growth will be identified. Available digitised information on soils and climate at a national level will be used as well as data from permanent and temporary sample plots in Douglas fir stands.

Nature-based management of beech in Europe

Project Manager: Dr P.S. Savill
Researchers: Mr E. Mountford and Mr T. Clements
Consultants: Mr R. Pakenham and Dr G.F. Peterken
European Union 5th Framework Project

This is a four-year programme focussing on sustainable management of European beech forests, and involves a multidisciplinary team of scientists from OFI, Denmark, Netherlands, Germany, Hungary and Slovenia.

During the first year the main areas worked on by OFI were: (i) natural stand dynamics in European beech forest reserves, (ii) ecology of tree regeneration in European beech forests, (iii) contemporary management of European beech forests, and (iv) historical spread and development of beech forests across Europe. Protocols for co-operative work were established for these, following attendance at the opening meeting of the project in Slovenia.

Recording and/or data analysis/report writing has been based on permanent tree and ground vegetation plots in several minimum intervention beech reserves at Lady Park Wood (lower Wye Valley), Denny Wood (New Forest), Noar Hill (Hampshire), and Buckholt Wood (Cotswolds).

Three reviews of natural stand dynamics, natural regeneration, and past-management of British beechwoods have been started. The latter has been exemplified by a case-study on beech management in the Chilterns and interview with an expert forester.

A project homepage has been established (http://www.flec.kvl.dk/natman), where several British end-users have already been encouraged to join the project mailing list.

Long term re-structuring of Chilterns Woodlands

Project Manager: Dr P.S. Savill
Research Assistant: Mr T.J. Clements
Funded by: Trans National Woodland Industries Group (TWIG)

TWIG is a European Union funded project that aims to produce information and guidance to assist long-term sustainable management planning to improve the productive potential of Chilterns woodlands, especially for high quality timber. OFI has been contracted to execute Research Project 1 – the long term re-structuring of Chilterns woodlands to enhance the potential for production of high quality timber. Under this project, emphasis is also to be placed on natural regeneration, and the potential for continuous cover forestry, and the naturalization of the existing woodlands.

A field survey of randomly selected Chilterns woodlands was initiated and completed late in 2000. Survey results will provide information on the current status of the woodlands, and indications of future directions. In particular an Ecological Site Classification will be produced for three major timber species – Ash, Beech and Oak – with the aim of identifying ecological variables that correlate with different quantities of natural regeneration and the quality of timber production. Based upon these results, and literature reviews, it will be possible to evaluate the feasibility of different management practices (*e.g.* continuous cover forestry) in the Chilterns, and the prospects for naturalizing the woodlands through the use of natural regeneration. Research may be able to suggest ways to enhance the economic potential of forestry in the region, through identification of those sites with good prospects for the production of high quality timber by particular tree species.

It is possible that as a result of this work the types of grants that may help further good management can be suggested (*e.g.* favour natural regeneration on some sites, and planting on others). The level of such grants will be suggested by an associated economics exercise for determining the costs of converting to and then running continuous cover forestry, as opposed to current clear felling.

The economic exercise forms part 2 of the research project and is due to start in the summer of 2001. It aims to provide information for potential industries as to the assured annual supplies of timber likely to be available. For this it will be necessary to analyse the current nature of the woodlands, and the constraints imposed upon management for timber production, in the high quality protected landscape of the Chilterns. The work will require assessments of the standing crops and annual increments (*i.e.* areas by species, age classes, growth rates). The potential availability of timber to the market is an important factor too. This will require an investigation into the small-scale ownership patterns across the region, and consideration of how this pattern causes difficulties in implementing policies.

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

There are around 225,000 ha of plantations created on ancient woodland sites (PAWS) in Britain, and 40% of our ancient woodland is PAWS rather than semi-natural woodland. There is growing interest in restoring a proportion of this area to semi-natural composition, arising in particular from the emphasis placed on this in certification standards. This research, which is split into six components, aims to increase our understanding of the ecological, silvicultural and economic aspects of PAWS restoration.

The first component will be to generate some better data on the resource, through fresh analysis of existing data-sets. Attempts will also be made to estimate potential semi-natural woodland type through use of the Ecological Site Classification model being developed by the Forestry Commission. Concomitant with this will be a review of the relevant ecological literature to establish the science that ought to be guiding current approaches to restoration.

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*, an African species of mahogany, for use in afforestation programmes, either for the enrichment of natural forests or for the rehabilitation of degraded areas and plantations in rural areas. Domestication of this species and the establishment of large plantations is hampered by its susceptibility to attack by a shoot borer in the genus *Hypsipyla*, which destroys the apical shoots, causing branching and forking, reducing the quality of the timber.

The research is being carried out in the mountainous region round Moribane (Manica Province of Mozambique, 1300 km north of Maputo). *Khaya anthotheca* occurs naturally in this area.

Trials have been established that aim to identify practices which reduce the susceptibility of *Khaya* to attack by *Hypsipyla*. These include investigating different aspects for planting, distances from perennial streams and levels

of canopy cover (shade). A second trial is investigating the effect of family (progeny from different mother trees) on susceptibility to attack in the nursery, under three different levels of shade. In addition, a progeny trial has been established to investigate possible differences in tolerance to attack by *Hypsipyla*, resistance to it, and ability to recover after an attack among progenies from 10 mother trees of *Khaya anthotheca*. This experiment is replicated 30 times in single tree plots.

Other work includes decapitating *Khaya* seedlings in the nursery to determine their capability of recover a good form; a survey to determine the sites and conditions where *Khaya* regenerates well; an assessment of the presence and abundance of *Hypsipyla* in the study area, larvae being collected both in natural forest and in plantations.

The serious and tragic floods in Mozambique, during the beginning of 2000, caused serious disruptions to Ms Alves' research.

The ecology and silviculture of *Swietenia macrophylla* in the State of Pará, Brazil

Project Managers: Dr N.D. Brown and Dr S.B. Jennings
DFID Project R.6912

The year saw the final stages of this DFID funded research project. In all, nearly 1200 ha of forest that had previously been logged for mahogany have been inventoried. The density of living mahogany trees >10 cm dbh (0.06 – 79 ha^{-1}) was always comparable to the density of trees logged (0.03 – 1.41 ha^{-1}). The density of juveniles (seedlings to trees <10 cm dbh) was 22-590 times that of commercial-sized stems (>45 cm dbh), leading us to conclude that, contrary to other reports, mahogany regenerates strongly after logging.

In all study areas, mahogany trees were located significantly closer to the many seasonal streams that dissect these forests than expected by a random distribution. Controlled experiments in the forest showed that large canopy openings were necessary for high survival and height growth of seedlings, but that there was no difference in survival and growth between valley bottom and ridge sites. Mahogany seed disseminates in the dry season, but there is little germination until after the first heavy rains. As it lies dormant on the forest floor, a large proportion of seed (average 67%) is eaten by a spiny rat, *Proechimys* cf. *guyannensis*-group. Mahogany seed can, however, escape seedling predation by germinating, which should happen earlier in the humid soils close to watercourses. The forest - scale distribution of mahogany is concluded to result from interactions between phenology, climate, topography, seed predation and canopy disturbance.

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)

The last year was spent completing the DPhil thesis that was submitted in August 2000. Some further work is now required before the thesis can be accepted and this should be completed by March 2001.

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 (South Kodagu), which is affiliated to the University of Agricultural Sciences, Bangalore, India. The project is funded by the 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 Coorg (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.

During the year 2000, several statistical tools and techniques were used on the collected data to be able to understand the general pattern of diversity in three ecological groups of organisms across the cultural landscape. The findings were presented in the form of talks and posters at conferences in Cambridge and Liverpool (UK) as well as in Missoula (USA). The last phase of fieldwork was carried out between September and December 2000 for collection of supplementary data and surveying the study area using a GPS (Global Positioning System) to obtain geographic information.

We will now be analysing the diversity patterns in the landscape context by mapping the forest patches with the help of MapInfo, a GIS based software. Landscape ecological analyses will enable us to explain the patterns of diversity in distinct ecological groups. The writing of the thesis will be completed by the end of Summer 2001.

Ecology and patch dynamics of *Megaphrynium macrostachyum*, a giant tropical forest herb in the Ndoki National Park, Central African Republic

Researcher: Ms T. Brncic (MSc by Research)
Supervisors: Dr N.D. Brown, Dr D. Harris (Edinburgh University)

Although most species of tropical forest herbs grow and reproduce more readily in sites that receive more light, the giant (4m) forest herb *Megaphrynium macrostachyum* (Marantaceae), is unusual because of its occurrence in large monodominant patches, which appear to be capable of delaying tree regeneration in forest gaps. Experimental and descriptive studies of *M. macrostachyum* were initiated in the Central African Republic in order to understand the autecology and competitive interactions that control their local patterns of abundance and distribution. 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?

One year's data on the growth and reproductive habits of *M. macrostachyum* have now been collected by censusing monthly patterns of leaf, flower and fruit phenology in relation to light environment. Experiments were completed on the rate of tree seedling emergence and mortality in artificially defoliated and control plots within *M. macrostachyum* patches as compared to forest understorey plots.

In addition to phenological surveys and competition experiments, a survey of herb distribution in relation to soil, topography and light availability was carried out over the 10 sq km study area. Most significant was the discovery of abundant charcoal in the area, as well as several sites with pottery fragments dating back 600 and 2000 years B.P. This indicates that *M. macrostachyum* patches may be a persistent form of secondary forest resulting from past anthropogenic disturbance.

Rattan diversity and sustainable management in Lao Peoples' Democratic Republic

Project Managers: Dr N.D. Brown and Dr J. Dransfield (RBG Kew)
Researcher: Mr T. Evans (DPhil student)
Darwin Initiative Project

Trade in rattan canes and edible shoots is an economically important activity in the Lao People's Democratic Republic (Laos), yet most of the supply comes from declining, unmanaged natural stocks. This joint project between OFI, the Royal Botanic Gardens, Kew, and the Forestry Research Centre, Lao PDR, aims to support improved rattan management through applied research and training of Lao scientists. A taxonomic revision covering Laos and neighbouring countries has been completed and has confirmed that 50 species occur in this region, over 20 of which are economically useful. Eight newly-discovered species are being named whilst many previously named species and varieties are no longer considered to be distinct. A colour field guide is being produced in both Lao and English-language editions, illustrated by one of the Lao staff trained by the project. In parallel with this, ecological research has been conducted, including a study of the regeneration and growth rates of one important commercial species and trials of several methods for rapid assessment of rattan stocks and growth rates. Plantation management of one rattan species for edible shoot production has been adopted in Laos in the past few years and some studies have also been conducted on this subject.

Mathematical modelling 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 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. A simple competition-colonisation model has already been developed, consisting of a system of differential equations. The model describes the time evolution of the population density of different tree species interacting in a variety of ways, recruitment, establishment, growth and death. The aim of this simple model is to try and identify the mechanisms that drive species diversity.

Two such models have been examined: one involving competition between different tree species; and another where competition is removed entirely. Mathematical analysis shows that neither model can exhibit species diversity. An additional mechanism is needed for the high diversity to be reproduced.

Within this model framework, the inclusion of random fruiting events is the crucial factor necessary to successfully predict species coexistence and mimic correctly the field observations of rainforest tree dynamics. Another finding of the model, is that parameters values required to predict diversity are much more realistic for the no competition model. The whole role of competition may need to be reassessed.

Future work will include modification of the model to make it more realistic and improve on its short comings. For example including age-structure or vertical layers into the canopy and studying the population dynamics of each group. Verification of the model and parameters will also be carried out by data collection in Danum Valley.

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

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

The genus *Quercus* L. is one of the largest tree genera in the northern hemisphere; it is one of the eight genera of the **Fagaceae** family. Even though this genus has been intensively studied in North America and Europe, in México it has poorly studied from an ecological and silvicultural perspective. In order to formulate management alternatives that accurately reflect productive potential, and to promote its conservation, a better understanding of the basic ecological process that underline the dynamics of oak and associated species is needed. Thus, this project aims to describe qualitatively and quantitatively the full range of structure variation and species composition of oak and mixed oak forests; and to identify feasible patterns of canopy species composition with respect to stand, site and environmental conditions, in the Sierra de Manantlán, México. Emphasis is on investigating the performance of episodic regeneration successes and subsequent recruitment into the adult stage. The study will be used to formulate silvicultural systems and alternatives of management that reflect the productive potential of these ecosystems. This project involves the establishment and re-measurement of 105 permanent sample plots (500 m^2 each), established during 1991 (n = 32); 1994 (n = 28) and 1999 (n = 45), spread over the study area.

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, 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, 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*, covered the taxonomy, ecology, uses, markets and sustainability issues. They are to be published in 2001 as part of a multi-author book.

Successful DPhil thesis

Juglans regia L: genetic variation and provenance performance

Researcher: Mr G.E. Hemery (DPhil student)
Supervisors: Dr S.A. Harris, Dr S. Head (Northmoor Trust) and Dr P.S. Savill

A range-wide collection of *Juglans regia* seeds was undertaken in autumn 1997 from 12 countries, including 25 provenances and 375 half-sib progenies. 2200 seedlings were produced using innovative nursery techniques. The seedlings were planted in three provenance trials in southern England in 1999, the largest of which acted as a combined provenance/progeny trial. After one growing season, survival was 98.9 %, mean height growth 35 cm, and mean stem diameter increment 5 mm. Provenance differences for both height and stem diameter increment were highly significant ($p<0.001$). There were no significant genotype environment interactions. Flushing assessments revealed few significant differences between provenances and flushing was complete by early April. Family heritability for tree height was 0.19 at one site and, with combined selection, genetic gain was estimated at 8 %.

The effects of three types of treeshelter and a stumping treatment on walnut establishment were tested over three growing seasons. Treeshelters were found beneficial to height increment. However, 120 cm tall shelters promoted early flushing, and consequent risk of increased frost damage, and caused more stem die-back than 75 cm shelters. Stumping promoted rapid early height increment but gave no longer-term benefit. The crown (*cd*) and stem (*dbh*) diameter at breast height relationship of open growing trees in Britain was assessed and was highly significant ($r^2 = 0.96$, $p<0.001$). The regression equation ($cd = 2.71 + 17.6\ dbh$) permitted the estimation of suitable planting densities for the provenance trials and the calculation of a thinning regime.

Isozyme analysis of the 375 genotypes identified 20 loci in 15 enzyme systems with seed embryo extracts. Using young leaf extracts, the polymorphic locus *Pgm*-1 indicated low expected heterozygosity of 0.06 both within populations and at the species level. F_{ST} and G_{ST} estimates, both 0.05, indicated high uniformity among populations. Genetic distance estimates did not identify significant clustering consistent with geographic origin.

Forest Genetics and Tree Improvement

Academic staff: Prof J. Burley
Research staff: Dr R.D. Barnes, Ms J.L. Stewart
Research student: Ms Y.M. Malheiros de Oliveira

Germplasm acquisition and evaluation

African acacias - monographs and manuals

Project Manager: Dr R.D. Barnes
Researcher and 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 1987and 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 Zimbabwe for forestry and agricultural extension workers, small scale farmers and teachers. In addition, the first 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 2000, progress was made on all four works but the volume of publications and documents to be abstracted for the monographs, and the difficult field conditions in Zimbabwe, caused some slippage in achieving the milestones. The FRP has recognized the problems and funded the project for a further six months so that the completion date is now 31 March 2001. The question of the completion of the conspectus has also been addressed and the FRP have agreed to fund this in the form of a further (part-time) extension of this project to 31 March 2003; but this does not include the cost of publication.

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: CIAT, Colombia; KARI, Embu, Kenya; University of Reading

Calliandra calothyrsus is a tropical leguminous tree which can provide dry season leaf fodder of high nutritive value, even on acid infertile soils, but it contains high levels of condensed tannins, and the reported feeding value varies widely. We have 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 leaf tannins have been shown to differ markedly between the provenances, not only in level but also in chemical structure. The two provenances have also been shown to differ in leaf digestibility, both *in vitro* and in feeding trials with sheep and goats at CIAT, Colombia, and in Embu, Kenya. Drying of the leaves, however, which has been widely reported to reduce digestibility, has been found to have no significant effect on digestibility, tannin level nor, most importantly, on animal production. Feeding trials in Embu showed no adverse effect of wilting the leaves before feeding them, on either growth rate of lambs or milk production in goats. These studies suggest 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.

During 2000 the main emphasis of the project has been on dissemination of these research findings, through both the scientific literature and through a range of leaflets and booklets aimed at tropical smallholder farmers and extension workers. In addition, three regional workshops have been held in Central America (Costa Rica), Africa (Kenya) and Southeast Asia (Indonesia) to disseminate the findings more widely and to discuss options for follow-up studies as well as ways to increase the developmental impact of the research.

Successful DPhil thesis

Investigation of remote sensing for assessing and monitoring the Araucaria forest of Brazil

Researcher: Ms Y.M. Malheiros de Oliveira (DPhil student)
Supervisors: Prof J. Burley, Dr M. Packer (Zoology) and Dr T. Dawson (Environmental Change Institute)
Sponsored by Brazilian Government

Southern Brazil has experienced a rapid deterioration of its forest resources during the last century, mainly due to the impacts of exploitative land use practices. Mixed Ombrophilous Forest with *Araucaria angustifolia* (Bertoloni) O. Kuntze (Veloso and Goes-Filho), is typically dominated by the species *Araucaria angustifolia*, also known as paraná-pine. Although the species is predominant, *Araucaria* forest also supports a complex, variable and regional ecosystem composed of many species, some of which are endemic to this forest type.

The present study focused on an area of the *Araucaria* forest biome located within the first plateau of Paraná State. It includes the Irati National Forest (INF), the only protected area with *Araucaria* forest in Paraná State.

The main goal of the thesis was to determine the relationship between vegetation and satellite remote sensing for assessing and monitoring *Araucaria* forest and ecosystems associated with the *Araucaria* forest region. The reflective properties and spectral signatures of the four main forest types in the INF (*Araucaria* forest, *Araucaria angustifolia* plantation, *Pinus elliottii* plantation and *Pinus taeda* plantation) were analysed and characterised. It was noted that spectral responses of *A. angustifolia* plantation and *P. taeda* plantation are similar. Standard Principal Component Analysis (PCA) revealed that the spectral data space could be reduced to three eingenvectors. The discrimination of *A. angustifolia* was achieved using the second component of the PCA using near infrared and mid infrared wavebands. Linear Mixing Modelling was undertaken to detect and identify *A. angustifolia* at sub-pixel level. The shade image was sensitive to forestry structure (density) and species differentiation. Use of the Normalised Difference Vegetation Index was successful in the biomass change detection using image differencing. These techniques were then utilised in an image differencing process, resulting in a proposed alternative monitoring system to detect forest changes in the *Araucaria* forest region.

Forest Biodiversity and Plant Systematics

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

Medicinal plants

Medicinal plants used by Luo mothers and children in Bondo District, Kenya

Researcher: Dr S. A. Harris

In cooperation with Dr Wenzel Geissler of the Institute of Anthroplogy (University of Copenhagen) and the Kenyan-Danish Health Research Project we are investigating medicinal plants used by Luo mothers and children in the Bondo District of Kenya, with a view to identifying plants that are useful in the treatment of common diseases. An ethnobotanical survey has been undertaken in the Luo region of Kenya and all of the species (c. 57 species) in approximately 90 plant remedies, mentioned by women and children, have been identified. These data have provided insights into Luo traditional medicine and the potentially new pharmacologically active substances.

Reproductive biology and genetic diversity

Genetic diversity and population structure of trees in fragmented dry zone forests of Central America

Project Manager: Dr D.H. Boshier
DFID Project R.6516

The project studied intra-specific genetic diversity, mating system, gene flow, phenology, localized adaptation and inter-provenance crossing in 'undisturbed' and fragmented tropical dry forests of Central America for four species (*Bombacopsis quinata*, *Cedrela salvadorensis*, *Leucaena salvadorensis*, *Swietenia humilis*). The genetic effects of fragmentation on remnant stands and trees are relatively unknown and currently under debate. Whilst fragmentation may reduce populations below critical size and gene flow to levels below that needed to prevent genetic drift, it may also increase or alter patterns of gene flow between remnant populations. Studies, in collaboration with Gemma White and Wayne Powell at SCRI, showed that, in both *B. quinata* and *S. humilis*, at the degree of separation studied (1 - 4.5 km), fragmentation does not impose a genetic barrier between remnants, but altered and enhanced levels of inter-fragment gene flow over longer distances, facilitated by the ability of pollinators to move between spatially isolated stands of trees. Research with Martin Billingham, concentrated on the implications of such altered patterns of gene flow in *B. quinata* and *S. humilis*, along with evidence for inbreeding/outbreeding depression and localized adaptation was completed. Although there was evidence for localized adaptation at a 50km scale, there was no evidence for outbreeding depression from the altered levels of gene flow. There was also increased seed production under increased disturbance for *S. humilis*, although not for *B. quinata*, whose conservation appeared to be limited by poor regeneration.

The genetic impacts of fragmentation are complex, but in some tree species pollination occurs over far greater distances and more frequently than previously thought, such that connectivity may be high across landscapes with little forest cover. With adequate gene flow and seed production, some remnant forest patches and trees may be important contributors to connectivity and conservation more generally. Their description as 'isolated' or 'living dead', with little or no conservation value, is for some species misleading and more human perception than a true reflection of any biological reality. It is more realistic to view remnant forest patches not as islands, but as existing within a mosaic of land uses which differ in their capacity to provide habitat or permit movement. Conditions in many large lowland estates are less propitious than on steep land under subsistence production. There will be a distance beyond which genetic isolation occurs, but determination is experimentally problematic, and thresholds will vary between species, depending on pollinator characteristics and availability, and specificity of the tree-pollinator relationship.

The project identified, with others, some of the potential for, and limitations to, biodiversity conservation at the forest/agriculture interface. There is a need to alter perceptions of conservation planners more used to traditional *in situ* conservation methods, to consider the possibility that trees outside protected areas have a role in biodiversity conservation. This requires the direct involvement of development organizations and an effective two-way communication between them and 'traditional' conservation organizations to ensure both conservation and development benefits. There is a need to raise awareness amongst development professionals of the value of natural regeneration both as socio-economic and conservation resources. Results were disseminated through courses, workshops and publications to a range of users. Four courses were taught in Honduras and Australia (total of 45 people from 16 countries). Participants held senior posts in government or NGOs,

covering national park planning/management, forestry research, natural resources management, *etc*. Under the project the purchase and distribution of 200 copies of the textbook *Forest conservation genetics: principles and practice* was funded to provide copies for key libraries and teachers in universities, forestry schools and research organizations in developing countries.

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

Project Manager: Dr D.H. Boshier
Dissemination Coordinator: Dr A. Schlönvoight (CATIE)
Source Book Coordinator: Mr J. 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 emphasize 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 preliminary project web page has been set up at: www.geocities.com/pamfrp/ giving basic information about the project. After revision this will be transferred to the CATIE server and will contain drafts of project publications for revision by collaborators.

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 Managers: Dr C.E. Hughes and
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. During autumn 2000, Colin Hughes left the project, leaving William Hawthorne and Rosemary Wise.

We have established links with Limbe Botanic Garden, where we are planning tests on Cola guides (22 species). In Ghana, workshops were held to discuss the contents of various planned guidelets. Formats for a tree guide with no words were debated and tested, and a format agreed on as a basis for a trial 'Photoguide to the large trees of Ghana'. Numerous photographs were taken with a digital camera towards this end. We also tried out on potential users various formats of NTFP and interesting plant guides in Ankasa reserve. Full testing of a variety of guide formats, for accuracy, useability and user appreciation will be conducted in 2001 in Ghana, Grenada and Cameroon.

Forest Biotechnology

Academic staff: Dr M.M. Campbell
Post doctoral research: Dr S. McInnis, Dr J. Willment
Research students: Ms A. Collins, Ms H. Jones, Ms L. Juda, Ms L. Newman, Ms L. Rogers
Technical staff: Mrs C.M. Surman

Molecular genetics of tree development

Tree 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 tree growth and development. In addition, we use our data to devise strategies for the biotechnological improvement of tree species for industrial end-uses. The major interests of our group include:-

The control of wood formation

Researchers: Ms L. Juda, Dr S. McInnis, Ms L. Newman, Ms L. Rogers and Dr J. Willment
Sponsor: BBSRC

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 focuses 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 hypothesize 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.

The second focus of our work on wood formation involves the analysis of mutants with altered accumulation of lignin, an important component of xylem cell walls. Normally, arabidopsis plants accumulate lignin in xylem cells and in the sclerified parenchyma. Based on exciting results obtained by several undergraduate research project students working in our lab, 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 characterization of these mutants, and the cloning of the genes corresponding to the mutant loci. We anticipate that these results should reveal important insights into the regulation of lignin accumulation.

The control of maturation in trees

Researcher: Ms A. Collins (DPhil student)
Supervisor: Dr M.M. Campbell
Sponsor: Shell International Renewables

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.

The control of growth and form in trees

Researcher: Ms H. Jones (DPhil student)
Supervisor: Dr M.M. Campbell
Sponsors: Shell International Renewables and BBSRC Case Studentship

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.

Forest Policy and Management

Academic staff: Dr S.N. Pryor
Post-doctoral research: Dr J.D. Hubert
Research student: Mr T. Curtis, Mr M. Markopoulos

Protected forest areas

Project Manager: Dr S.N. Pryor
Researcher: Mr T. Curtis
Consultant: Dr G. Peterken
Funded by: Forestry Commission and WWF (UK)

There is a wide range of types of protected forest in the UK: Natura 2000 areas, National Parks, SSSIs, NGO nature reserves and voluntary measures. This study gathered data on the extent of all these various protective mechanisms and areas, and also evaluated their effectiveness. This analysis enabled the allocation of the various types of protected area to the IUCN Categories of Protected Area to be reconsidered. This revealed that the UK is very under-represented in the highest 'wilderness and natural reserves' categories. However, by taking into account areas subject to management agreements and to multiple measures (*e.g.* ancient woodland and SSSI) a rather more positive picture has been produced. It appears that 15-20% of UK woodlands could be considered as being within Categories I – IV (which compares with WWF global target of 10%). The study revealed that the data for most protection mechanisms is poor, and also that the IUCN definitions are not sufficiently clear to allow objective analysis and international comparisons.

Certification

Researcher: Mr M. Markopoulos (DPhil student)
Co-supervisors: Prof J. Burley, Mr S. Bass (IIED)
MSc students: Mr J. Willis, Mr A. Smith,
Mr P. Coventry and Mr K. Tonnisson (MSc Environmental Change)
Co-supervisor: Ms R. Nussbaum (SGS Qualifor)
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.

This line of work was continued through a link with a DFID funded project being undertaken by SGS on access to certification for small-scale forest enterprises. Jake Willis's findings in Ecuador and Alan Smith's in Papua New Guinea confirmed the view that the capacity of the community enterprises to access international markets would need to be increased before certification could act as an economic driver for better forest management.

Kristjan Tonnisson, having participated in development of the Estonian National Standard before coming to Oxford, took the opportunity to assess the adequacy of the science underlying some of the requirements. This revealed the limited level of knowledge underpinning some key requirements - for example on clear-felling limits - in all NW European standards. His research also involved an assessment of the costs associated with certification for three different types of forest: a small family owned/managed forest; medium-sized estate, professionally managed and the state forests.

Simon Pryor and Malcolm Campbell collaborated to supervise an examination by Peter Coventry (as his MSc thesis) of whether genetic modification (GM) and certification will ever be compatible. This analysed the perceived risks of using GM trees in plantations, and compared these with the risks associated with other operations allowed under certification standards. It also collated and reviewed the attitudes to GM and certification of some of the major players.

Restoration of plantations on ancient woodland sites

Project Managers: Dr N.D. Brown and Dr S.N. Pryor
Research Assistant: Mr T. Curtis
Funded by: Woodland Trust

See page 5 for details of this project.

Carbon sequestration in English semi-natural woodland

Project Managers: Dr T. Dawson (Environmental Change Institute) and Dr S.N. Pryor
Researcher: Mr B Briggs (Biology undergraduate)
Funding Source: British National Space Centre LINK Project

The overall aim of this project is to test the application of synthetic aperture radar remote sensing techniques for quantifying carbon storage in forests. OFI's role is to provide the field assessments of biomass and carbon which will then be used to ground truth the remote sensing data. The study sites are Monkswood in Northants, a typical mixed coppice woodland, and a part of Thetford forest containing pine plantations of various ages.

Quantifying and valuing wider environmental benefits of new woodland in the South West Forest

Project Manager: Dr S.N. Pryor
Post-doctoral Researcher: Dr J. Hubert
Funding Source: South West Forest Partnership

The South West Forest is a major initiative to create new woodland on marginal agricultural land in North Devon and Cornwall. This study was part of large suite of studies to quantify and evaluate the potential benefits. We were tasked with quantifying and giving an indication of possible value of wider non-market environmental benefits. These comprised: water quality, flood prevention, soil conservation and carbon storage. The analysis was based on a review of existing published estimates of these benefits, and applying these to the areas of forest likely to be created in the South West Forest.

Economics of continuous cover forestry

Project Managers: Dr S.N. Pryor and Dr P.S. Savill
Post-doctoral Researcher: Dr J. Hubert
Funding Source: Woodland Heritage

Continuous cover forestry (*i.e.* alternatives to clear-felling) is being promoted in most temperate and boreal forests. Whilst proponents claim that income is increased, and costs reduced, forest managers frequently claim that the management costs are prohibitive. This project was a brief review of the operational differences from conventional forestry, and the possible differences in costs and income. The aim was not to provide definitive costings, but to identify where the biggest costs lie (*e.g.* directional felling), and how they compare with the claimed economic benefits (*e.g.* reduced weeding). This will help pinpoint the activities/operations which are the biggest economic obstacles, and feed into the development of appropriate Government incentives.

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

Project Managers: Dr N.D. Brown, Dr S.N. Pryor, 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)

In this study a leading team of researchers is appraising the feasibility of creating 'wilderness woodlands'. These will be extensive areas of woodland comprising native species, and established using low intensity silvicultural techniques such as natural regeneration/colonisation, on land which it is likely could come out of conventional agricultural production.

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, Mrs J.P. Smith

Ecophysiology

Academic staff: Mr F.B. Thompson

Work continued on the mass transfer component (water movement in the liquid and vapour phases) of the simulation model of wood drying kilns using solar energy. Given the physical basis of the model it has applications to a wide range of radiant, thermal and latent energy transfer systems.

A shelter coefficient (SC) has been established by wind tunnel and field experiments. The SC is a value relating to changes in both the mean wind speed and its turbulence resulting from shelter. Further studies are planned for a range of sites to test the correlation between the shelter coefficient and microclimatic parameters.

Biometrics and Inventory

Project Manager: Mr H.L. Wright

Documentation of UK holdings of growth and yield, inventory and other data from tropical forests

Project Manager: Mr H.L. Wright
Research Assistants: Ms N. Baker and Mrs J.P. Smith
DFID Project R.7277

Considerable amounts of data from static and recurrent inventories and volume table construction are held in UK organizations. Many of these data are now no longer available in their country of origin. They form a resource of valuable information on forest dynamics. This project was in collaboration with the Universities of Wales (Bangor) and Reading.

A meta-database (ATROFI – UK, Archive for TROpical Forest Inventory for data residing in the UK) was set up using Access. ATROFI-UK is a meta-database and therefore does not contain raw data but rather a summary of what is in the listed datasets and, most importantly, a contact address of the holder of the raw data. A project web page was created (http://www.atrofi-uk.com) from which the database can be searched by type of data, country and species. Other outputs from the project are also available on the web site. Currently the database contains a total of 122 records of studies comprising 30 permanent sample plots studies, 22 natural forest inventories and 70 sets of species volume functions. A total of 23 tropical countries are involved. It is emphasized that, although a number of datasets have been documented and catalogued, the actual raw data is not yet secure. Although the project finished in April 2000 more datasets are being added to the database.

A two-day workshop, entitled *Maintaining Forest Data for Future Use*, was held at Reading on 30-31 March 2000 to consider archival policy and practice for historic and current tropical forest inventory data. The workshop consisted of two parts: first, presentations on the form and functioning of archival systems and, second, a discussion on archival policy for tropical forest data. The main recommendation to arise from the workshop was the need for all projects, whether research or bilateral, to be pro-active concerning the management of data collected. Projects should have a data management plan incorporated into the project memorandum which would detail not only the management of data during the life of the project but the arrangements to be made for its archival after the end of the project. The report of the workshop is available on the website.

Humid and semi-humid tropical forest yield regulation with minimal data

Project Manager: Mr H.L. Wright
Research Assistants: Ms N. Baker and Mrs J.P. Smith
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.

During the year the proceedings from the workshop that was held at CATIE in Costa Rica were published as an

OFI Occasional Paper (Wright, H.L. and Alder, D. (Eds) 2000 *Proceedings of a Workshop on Humid and Semi-humid Tropical Forest Yield Regulation with Minimal Data.* CATIE, Costa Rica, 5-9 July, 1999. Oxford Forestry Institute, Occasional Paper 52). Copies of the abstracts are available on the project website (http://www.bio-met.co.uk/R7278/index.htm) and the full papers can be downloaded. Another paper (Alder, D., Oavika, F., Sanchez, M., Silva, J.N.M. and Wright, H.L. A method for calibrating growth models for tropical moist forest with minimal data) has been submitted to *Forest Ecology and Management*.

Preparations are being made for a workshop to be held in Oxford in April 2001 when the system will be demonstrated to those who attended the CATIE meeting. In cooperation with another DFID (FRP) project based in Edinburgh, which has constructed an individual tree model for dipterocarp forests in Indonesia, an exit strategy is being developed which will compare both approaches for two or more specific areas. This project extension will also involve training periods in the use of both systems.

Cultural Ecology

Academic staff: Mr P.J. Stewart

Mr Stewart accepted an invitation to lecture on the cultural ecology of the Near East for the Oriental Faculty. Preparation for this has provided an opportunity to research into the past 12,000 years of ecological history in the area and to find further material for his ecology book, the essence of whose argument was presented in chapter 18 of *"Where next? Reflections of the human future*", edited by Duncan Poore, former Director of the OFI. Mr Stewart also contributed articles to "*The Companion to African Literatures*", edited by Douglas Killam and Ruth Rowe, published by James Currey.

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*

The Institute's one-year taught MSc, now in its 28th year, continues to be highly regarded. 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.

Seventeen students were admitted to the 2000/2001 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. One third of the students are British, most with first degrees in biological sciences. Those from overseas come from Cameroon, Germany, Ghana, India, Japan, Malawi, Malaysia, Papua New Guinea and USA.

The Natural Environment Research Council (NERC) and Department for International Development (DFID) were the major sources of financial support for British students following the course. The Hosier Fund and Lloyd Studentship, both associated with Linacre College, were also major contributors in two cases and the Queen's College in one.

1999-2000 class

The dissertations submitted were entitled:-

Ms Elinor Breman
Seed dispersal and forest rehabilitation.

Mr Giovanni Cordobo Mosquera
*Understorey interactions between Ash (*Fraxinus excelsior L.*) and Sycamore (*Acer pseudoplatanus L.*) in two British woodlands.*

Mr Peter Coventry
Forest certification and genetically engineered trees: will the two ever be compatible?

Mr John Dale
Investigation into the structure of a beechwood ectomycorrhizal community. Use of morphotype and PCR analysis to profile community components.

Mr Filippo Del Gatto
Company-community partnerships in the forest sector: case studies from Central America.

Mr Daniel Edmonds
Charcoal, carbon and cash.

Ms Suzanne Enoh
Mount Cameroon project's institutional policy on equitable benefit sharing from Prunus africana *exploitation as experienced by the Mapanja local community.*

Mr Premysl Macel
Changes in the species composition in the forests of the Czech Republic in response to changing policies, and their consequences.

Mr James Paterson
Modelling potential distribution changes of European tree species in response to climate change and the consequences for W12 Fagus sylvatica-Mercurialis perennis *woodland in south-east England.*

Mr Marcel Robischon
Development of a conservation strategy for Faidherbia albida (Del) A. Chev. *on the basis of variability in choroplast and nuclear DNA.*

Ms Vandana Singh
Social inequality and forests. A study of policies, institutions and impacts with special reference to Himachal Pradesh, India.

Mr Alan Smith
Group certification in Papua New Guinea.

Ms Aoife Smith
The impact of agricultural reform on national forest

policy; a review and comparative analysis of Ireland, France and New Zealand.

Mr Kenley Thomas
The study of Milicia excelsa.

Ms Rhonda Urlin
A situational analysis of the impact of forestry education on Guyana's forestry sector.

Mr Hans-Albrecht Wiehler
The risk in forest production planning on marginal sites in the Gräflich v. Bernstorff'sche Forstverwaltung Gartow.

Mr Jake Willis
The potential for community forest certification in Ecuador.

The Jubilee Prize

This prize was awarded to Mr Peter Coventry (Linacre College).

The Director's Prize for the Best Dissertation

This prize was awarded to Mr Jake Willis (Linacre College).

2000-2001 class

Mr Franz-Eugen Arnold
Forestry, Rottenburg, Germany

Ms Rose Bell
Agriculture, Bunda, Malawi

Mr Cameron Campbell
Landscape architecture, British Colombia

Mr Stephan Gale
Natural sciences, Cambridge

Mr Tobias Jackson
Tropical environmental science, Aberdeen

Ms Tonya Lander
Botany/anthropology, Washington, USA

Mr Weston Mwase
Agriculture, Bunda, Malawi

Mr Antwi Oduro
Natural resources management, UST, Ghana

Mr Koki Okawa
Forest science, Tokyo, Japan

Ms Caroline Pridham
Zoology, Bristol

Mr Timothy Rayden
Applied biology, Bath

Mr Vishnu Sharma
Forestry, Pant Nagar, India

Mr Belmond Tchoumba
Natural sciences, Yaounde, Cameroon

Mr Stephen Teo
Botany, Kebangsaan, Malaysia

Mr Pelis Vatnabar
Forestry science, University of Technology, PNG

Mr Ben Vickers
Forest management, Aberdeen

Mr Alistair Yeomans
Horticulture, Strathclyde

Post-Experience Training Courses

Current Methods in Tropical Forestry

This was the 4th year that this course has been run and included the following participants:-

Mr Gurbaz Singh
Mr Swarn Singh
Mr C. K. Shahi
Mr Mewa Singh

These were from the Punjab Forest Department and either conservators or deputy conservators of forests funded by the Japanese government. A fifth candidate, Mr Ngatara Kimaro, was a forester from Tanzania working on the Lake Victoria rehabilitation project and funded by the World Bank. The course followed the established form and including inputs from all the member organizations of the TFRG and also included a tour to forestry institutes in Germany and France.

Research Students

Sixteen of the research students registered in the Department of Plant Sciences in 2000 were working within the Institute; their work is described in earlier sections of this report. Two students, Mr G.E. Hemery and Ms Y.M. Malheiros de Oliveira successfully defended their doctoral theses.

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

A herbaria and xylarium website is now available via the OFI website. This site contains basic information about the collections and details of the lichen and xylarium collections. Curation of FHO has continued to be a major task. Parts of FHO were curated as material was returned to Oxford following taxonomic revision, including *Premna* (Verbenaceae), *Euphorbia* (Euphorbiaceae) and *Toona* (Meliaceae), or when parts had been used by visitors, including *Acacia*, *Afzelia*, *Brachystegia* and *Millettia* (Leguminosae), Irvingiaceae, *Cola* (Sterculiaceae), Capparaceae and genera in the Rubiaceae. These curation exercises have meant that space within FHO is becoming critical. Work on the curation of the spirit and carpological collections is now complete. All of the carpological material has now been databased in Microsoft Access and incorporated into the collection. The collection comprises nearly 4000 accessions, primarily Meliaceae and Leguminosae. *Brachystegia* accessions have been curated which means that for the first time in nearly 70 years the collections are easily accessible.

Between October 1999 and September 2000, 130 researchers visited the collections. These included Professor Mark Seaward (Bradford University) and Professor Teuvo Ahti (University of Helsinki) spent one week (in February) working on the lichen collections. Dr Hazel Chapman (University of Canterbury, New Zealand) spent one month working on the Nigerian forest flora and Dr Karel Jongkind (WAG) spent one week working on the West African forest flora. Individual visitors were interested in Neotropical Ebenaceae and woody legumes, African woody legumes, African ferns and medicinal plants, *Aglaia* and *Toona* (Meliaceae), *Malus* (Rosaceae) and the identification of Egyptian tomb remains.

Ian Gourlay continues to be involved in the examination of wood from local archaeological digs (c. 15,0000 old) in collaboration with Dr Kate Scott (Pitt Rivers Museum, Oxford) and provided crucial wood identifications for the authentication of some Chippendale chairs. On 22 November 2000, Ian attended the long awaited publication on King Arthur's Round Table in the Great Hall of Winchester Castle. In the late 70's, the table was taken down from the wall in the Great Hall and examined by a team of historians and scientists, assembled by Professor Martin Biddle (Professor of Medieval Archaeology at Oxford and Astor Senior Research Fellow and Tutor in Archaeology at Hertford College). Ian assisted Professor A.C. Barefoot (then head of Wood & Paper Science, North Carolina State University, Raleigh North Carolina) in the dendrochronological investigations, sampling and measuring rings on over 30 of the oak boards composing the surface of the table (5.2 m diameter, 1270 kg in weight). The data from these measurements was subsequently smoothed and 'fitted' to master curves in order to arrive at 'suggested dates'. From these dendrochronology results and those of other researchers, Professor Biddle concluded that the table was probably made as a centrepiece of a feast held at Winchester in 1290 after a tournament to mark the culmination of Edward I's plans for the dynastic marriages of his children.

CABI-OFI Forestry Information Service

Head, Library & Information Service: Mr R.A. Mills
Special Collections Librarian/Archivist: Mrs A.M. Townsend
Reader Services Librarian: Mrs J.B.D. Pinfold
Trainee Librarian: Miss F.E. Hall (to 31.08.00)

2000 proved a landmark year for the Forestry Information Service and the Plant Sciences Library which operates it. Several years of anxiety over its future came to an end in July when the University's Council accepted the recommendation of the Forestry Review Panel that the Library and Information Service should be transferred to the newly-formed Oxford University Library Services (OULS) under the management of the Director of University Library Services, Mr Reg Carr. OULS, which has been some four years in planning, formally came into existence on 1 October 2000 and integrates most of the University's libraries into a single management structure. Although no longer run by the Department of Plant Sciences, the Library remains located within the Department, as it always has been, and all materials remain accessible to anyone with a serious interest in forestry or plant sciences.

The Library and Information Service will now be developed in co-ordination with other libraries in Oxford and, in recognition of the significant national and international role of the collections, with related libraries and information services in the UK and the rest of the world. The long-standing association with CAB

International continues and opportunities for developing new services within the context of the emerging Global Forest Information Service are now under discussion.

Contact details for the Library and Information Service from 1 November 2000 are as follows:

Postal address:
Plant Sciences Library
and Oxford Forest Information Service
Oxford University Library Services
South Parks Road
OXFORD OX1 3RB

Enquiries:
tel: +44 1865 275082 or 275087;
e-mail: enquiries@plantlib.ox.ac.uk
Roger Mills (Librarian and Information Service Manager):
tel: +44 1865 275080,
e-mail: roger.mills@plantlib.ox.ac.uk
fax: +44 1865 275095
web site: http://www.plantlib.ox.ac.uk

The old @plants e-mail addresses will continue to work until 31 July 2001.

The Global Module of the CABI Forestry Compendium on CD-ROM was published to great acclaim in the summer, launching at the IUFRO Congress in Kuala Lumpur where it rapidly sold out. Priced at $100 to individuals or $600 to institutions, with institutions in developing countries entitled to purchase at the individual rate, it seems assured of continuing popularity, and is already heavily used in the Library.

Tree CABWeb was further developed during the year and now offers subscribers on-line access to the past ten years of *Forestry Abstracts, Forest Products Abstracts* and the full 12-year archive *of Agroforestry Abstracts.* The latter journal is now only available in electronic form, setting what will no doubt be an increasing trend as our reliance on the computer for information retrieval becomes ever greater. CABI's forestry book publishing programme expanded with a number of new titles, including the first five volumes in the major new *IUFRO Research Series*.

The Global Forest Information Service, initiated as a IUFRO Task Force during Professor Burley's Presidency of IUFRO, was also successfully launched in Kuala Lumpur, and its first funded project, GFIS-Africa, is now under way with nodes based at five institutions across the sub-continent. Further details of GFIS are available on (http://iufro.boku.ac.at/iufro/taskforce/hptfgfis.htm). The Library is an active partner in the Task Force developing the Service, which is expected to go live during 2001.

It is also a partner in the new UK Higher Education-funded Internet gateway for the Life Sciences, BIOME, which was launched in November 2000. BIOME offers five sub-gateways providing evaluated, quality Internet resources in all areas of the health and life sciences. The Library co-ordinates the AgriFor gateway covering agriculture, forestry and food, and contributes resources in forestry to that and in botany to the Natural World gateway led by the Natural History Museum in London. In December 2000, the Finnish Forest Research Institute, METLA, became a Trusted Information Provider for BIOME, and will contribute forestry resources to BIOME instead of the Virtual Library for Forestry (VLF) hitherto managed there; the VLF will gradually be incorporated into BIOME. A new sub-gateway specifically for forestry will be developed as part of BIOME and will also be incorporated in GFIS, thus tying the two projects together.

At an international meeting of agricultural subject gateway providers in Washington in the Spring, opportunities for international collaboration were explored and the practicalities of cross-searching different gateways in different countries considered. A consultancy report, commissioned by the Australian gateway AgriGate, on the options available was completed in October and is now under consideration. A further meeting at FAO in June, the first Consultation on Agricultural Information Management (COAIM) also supported international collaboration and a follow-up technical meeting in Brussels produced a draft set of specific recommendations for a core set of metadata for agricultural documentation, with reference to existing metadata standards (such as Dublin Core and RDF), classification schemes (such as those adopted in AGRIS/CARIS and CABICODES), and controlled vocabularies/thesauri (such as AGROVOC and the CAB Thesaurus). Interaction with the GFIS Task Force has resulted in a proposal for joint development with FAO, CABI and others of metadata standards for forestry, which will be pursued in 2001.

As part of the development of IUFRO subject group S6.03, Information Services and Knowledge Organization, it has been agreed to set up a European network, FORELISE: Forestry Libraries and Information Services in Europe. As a first step, a new electronic discussion list will go live in January 2001; joining details are available from: roger.mills@plantlib.ox.ac.uk.

Finally, as the year ended a bid was prepared for submission to the British Library's Co-operation and Partnership Programme to set up a web-based Clearing House for Information in Plant Sciences (CHIPS). This project, if approved, will be led by the Plant Sciences Library in collaboration with the British Library, the Centre for Ecology and Hydrology, Imperial College London, the Natural History Museum, Royal Botanic Garden Edinburgh and the Royal Horticultural Society. It aims to improve access to information in plant sciences,

agriculture and forestry, providing a common gateway to library catalogues, document delivery services, full-text documents and an on-line reference service, and leading to a national, and possibly European, collection development policy for the subject.

For further details of the Forestry Information Service see: (http://www.plantlib.ox.ac.uk).

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 project news 2000

Outside the UK, Brahms herbarium database projects are now active in Europe (Baltic States, Germany, Netherlands, Portugal); Africa (Benin, Cameroon, Gabon, Ghana, Kenya); Asia (Bangladesh, Malaya, Sabah, Sarawak, Singapore); and South and Central America (Brazil, Honduras, Panama, Puerto Rico). Each of these sites and the larger number of individual research databases will be upgraded to Brahms 5 early 2001. In Amazônian Brazil (IAN, INPA, MG), Malaysia (KEP, SAN, SAR) and the Netherlands (L, WG, U), regional networks are in the pipeline.

System development

Brahms 5, built using Visual FoxPro, is entering the final stages of development. Some modules are already in use and the full system will be phased in early 2001.

Version 5 is very different to the previous incarnations of Brahms, as one may expect from a DOS to Windows translation. The system has an entirely new interface with new menus and messaging, toolbars, reporting options, printer links and network capabilities. Aside from the new interface, there are substantial additions to its data storage capabilities and overall functionality.

The ***Brahms 5 for Beginners*** tutorial guide will be available on (www.brahmsonline.com) in February 2001.

Oxford

The entry of the FHO collections continued and two substantial database projects leading to publication were approaching completion: a revision of Javanese *Strobilanthes* by Jonathan Bennett (http://users.ox.ac.uk/~dops0152) and the Checklist of Mount Mulanje, Malawi, being prepared by Alison Strugnell. Towards the end of the year, Colin Hughes made a start on his revision of *Lupinus* – starting with the import of names downloaded from the IPNI web site (http://www.ipni.org) into a Brahms 5 RDE taxon file.

Brazil - Amazônia

Four herbaria in the Amazonian region of Brazil are now using Brahms. These are EMBRAPA Amazônia Oriental (IAN) and the Museu Goeldi (MG) herbaria in Belém, Pará, the Instituto Nacional de Pesquisas da Amazônia (INPA) in Manaus, Amazonas, and the HAMAB herbarium in Macapá, Amapá. Together, these herbaria house over 600,000 collections. Coordinated by Regina Martins da Silva, Ricardo Secco and Rosângela Sarquis, with funding support from UK DFID and the Superintendência do Desenvolvimento da Amazônia (SUDAM), over 100,000 collections have already been databased at the IAN, MG and HAMAB, covering 48 families, mostly Angiosperms. At INPA, where some 30,000 collections have been already entered, Rogério Gribel and Cid Ferreira are organising a Brahms course to be held at INPA early in 2001. A proposal to expand the database work across the region is now being prepared.

Puerto Rico

The University of Puerto Rico and the US Fish and Wildlife Service are funding herbarium database development, co-ordinated by Jeanine Vélez-Gavilán. She has also largely completed the translation of the Brahms web site into Spanish. The MAPR database is rapidly developing into a valuable source of species and collections data for the island.

Malaysia and Singapore

The Malay peninsula together with Sabah and Sarawak to the East, is one of the world's biodiverse regions with perhaps 15,000 species of vascular plants alone. Three main herbaria, Kepong in Malaya, Sandakan in Sabah and Kuching in Sarawak house some 600,000 collections in all. The herbarium of the Singapore Botanical Garden houses a further 650,000 specimens.

The database work now underway at each of these herbaria started at the Kepong herbarium (KEP), part of the Forestry Research Institute of Malaysia (FRIM). This work was started by the current KEP curator Saw Leng Guan.

The KEP herbarium began in early 1900s and has since grown to be the largest on the Malay peninsula (excluding Singapore) with some 200,000 collections of which over 500 are types.

Brahms operates on a local network linking the herbarium computers. Two technical staff have been specifically hired for data entry - which has now reached over 100,000 collections.

Last year, a FRIM fellowship grant was awarded to the Brahms project to support training visits and database development at Kepong.

ITTO course, Kuching, Sarawak

In November 2000, a training course for 22 curators and botanists from Malaysia and Indonesia was held in Kuching, Sarawak. The course was funded by the International Tropical Timber Organization (ITTO). One of the course objectives was to help to standardize databasing procedures in the three major Malaysian herbaria.

Netherlands – bibliographic module

The recently established National Herbarium of the Netherlands (NHN) with its Leiden, Wageningen and Utrecht branches, is working towards the creation of a unified NHN collections database, co-ordinated by Luc Willemse at Leiden. An additional contribution made through the library at Leiden has been to support the development of the new Brahms 5 Bibliography module. This has now been largely completed and provides the system with a comprehensive literature storage facility.

Portugal – legumes of Angola

The herbaria of Portugal hold a large number of specimens collected in Angola. Most of this material is unique and many of the collections are types. Although many duplicates of these specimens exist in Angolan herbaria, many determinations are in need of updating, a task that requires access to recent literature, mostly unavailable in Angola. The project *Leguminosae of Angola*, co-ordinated by Estrela Figueiredo at LISC, is assembling data from all the collections of Leguminosae kept in two Portuguese herbaria COI (University of Coimbra) and LISC (Centro de Botânica) using Brahms. Through this project, it will be possible to make these data available to the Angolan herbaria - and also to the scientific community worldwide, in the form of a Brahms database, checklists and publications.

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 18 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 now 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) or by e-mail at: (prospect@plants.ox.ac.uk.).

Database of Weeds and Invasive Plant Species

Coordinator: Dr P.S. Bacon
Consultant: Mr N. Waltham

During the year there have been several enquiries each month about the database arising largely through published articles on the project and from hits on the project web site (http://w3.to/weeds/). Outside of the UK copies have been distributed to Canada, Denmark, Germany, Iran and the USA. During the year a second version has been compiled in Visual Objects and the programming consultant to the project visited the UK to discuss future developments. The second version will be distributed on CD-ROM to existing subscribers and funding is being sought to develop an on-line version entitled the Invasive Plant Species Information System (IPSIS) that will have a capability for assimilating distributional data for research purposes.

EXTERNAL ACTIVITIES - INSTITUTIONAL

DFID Enabling Agreement

Coordinator: Mrs S.M. Hardaker

For the past twelve months contractual arrangements have been in place in the form of an Enabling Agreement whereby OFI undertook to supply professional services overseas as and when required by DFID. This year the area of most action was Brazil: namely on the bilateral Dendrogene Project - Genetic Conservation within Managed Forests in Amazonia - through which Denis Filer (database consultant) and Dr David Boshier (forest conservationist) visited to assist and advise. Denis Filer also visited Brazil on the G-7 Pilot Programme for the Conservation of the Brazilian Rain Forests to set up an integrated database at the Goeldi Museum, Belem.

Professor Burley continued to be given support through funds from this agreement in his role as President of the International Union of Forestry Research Organizations, until his presidency finished at the end of 2000.

The DFID Enabling agreement terminated during November 2000 and has not been renewed. Any subsequent undertakings by OFI consultants will be in the form of individual service agreements as requested through the DFID Contract Office in East Kilbride.

British Council Higher Education Link Scheme

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

Link Project with University of Nairobi

A workshop was held in Kakamega near Lake Victoria to formulate a research proposal targeted at the alleviation of poverty in the region and six UK-based consultants were funded under the Link agreement to attend the workshop. Funding was secured to support the attendance of participants from within Kenya and from adjacent countries. The outcome of these efforts was the preparation of a clear statement of research objectives which was formulated into a pre-proposal for consideration by the European Union. During the second half of the year the consultant to the project returned to Kenya to assimilate the required information to submit a full proposal. Information on the workshop and on the project is available at: (http://users.ox.ac.uk/~pbacon/nairobi).

Tropical Forest Resource Group

Chairman: Professor J. Burley
Secretary: Dr P.S. Bacon
Assistant: Ms N. Baker

Community Forestry Education Project in South Africa

Training courses in conflict management and communities in plantation forestry were conducted during the year and teaching support for Fort Cox and for Stellenbosch was funded by the project. An external review of the project was conducted by DFID with inputs from the TFRG representative from Cranfield University, Silsoe College.

Other

The secretariat continued to operate from OFI for the sixth year and on behalf of the consortium continued to pursue a range of project opportunities for the group. The secretariat successfully completed the implementation of a 4th year of the course *Current Methods in Tropical Forestry* (*qv*) on the basis of significant international client demand. There have been several enquiries regarding membership of the group with one new member being admitted during the year and formal applications made by two other possible member organizations.

STAFF PUBLICATIONS

Barnes, R.D. (2000). **The African acacias: a thorny subject**. Keynote address in *Forest genetics for the next millennium*. Proceedings of IUFRO Working Party 2.08.01, Durban, South Africa, 8-13 October 2000, 9-15.

Boshier, D.H. (2000). **Mating systems**. In *Forest conservation genetics: principles and practice (edited by Young, A.; Boshier, D.H.; Boyle, T.J..)*. CSIRO, Melbourne, Australia; CABI, Wallingford, UK. 63-79.

Boshier, D.H.; Young, A. (2000). **Limitations and future directions**. In *Forest conservation genetics: principles and practice (edited by Young, A.; Boshier, D.H.; Boyle, T.J.).* CSIRO, Melbourne, Australia; CABI, Wallingford, UK. 289-297.

Boshier, D.H.; Billingham, M.R. (2000). **Genetic variation and adaptation in tree populations: issues of scale and experimentation**. In *The Ecological Consequences of Environmental Heterogeneity (edited by Hutchings, M.J.; John, E.A.; Stewart, A.J.A.).* Blackwell Science, UK, 267-291.

Brown, N.D.; Jennings, N.D.; Wheeler, P.; Nabe-Nielsen, J. (2000). **An improved method for the rapid assessment of forest understorey light environments**. *Journal of Applied Ecology* **37** (6) 1044-1053.

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