

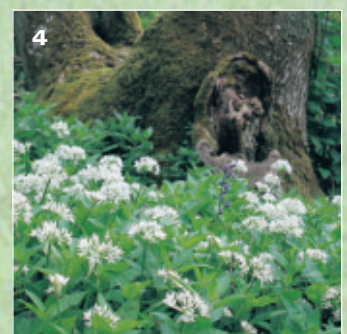
Chief Executive's Introduction

I am pleased to present the Agency's Annual Report and Accounts for the year ended March 2001.

The Agency has again had a successful year achieving all its targets despite continuing reductions in income from our main customer, the FC's Policy and Practice Division. Income from non-FC sources also declined as a result of several EU projects coming to an end, delays in obtaining authorisation to start new EU projects and reduced activity on the major short rotation coppice project jointly funded by MAFF, DTI and the FC. Foot and mouth disease affected some field work in the last few weeks of the financial year. The Agency was able to reduce costs in line with the reduction in income through non-replacement of staff on casual and fixed term appointments. Despite the need to make reductions in staff numbers we were able to make several new appointments in response to changing demands.



- 1 Enjoying a walk in Delamere Forest, Cheshire
- 2 Scots pine in the New Forest
- 3 Jim Dewar, Chief Executive
- 4 Oak with wild garlic in ancient woodland



Research highlights

Our research aims to protect Britain's trees and woodlands from pests, disease and other threats; to increase the contribution trees and woodlands make to improving quality of life including environmental and social benefits; and to increase the competitiveness of British grown forest products and their contribution to wealth creation. The following highlights describe progress on a selection of projects and illustrate the range of our activities.

Pest and disease management

Entomology Branch has taken the lead in developing a new approach to pest management (Integrated Forest Management, IFM) which includes a wide range of disciplines to achieve sustainable, long-term reductions in the use of pesticides in forestry. Initially IFM research is focusing on the biology of the pine weevil *Hylobius abietis* and its interaction with restocking as a forest management process. The role of plant quality is being assessed in relation to the ability of transplants to tolerate different levels of attack. The population dynamics of *H. abietis* are being examined in order to develop predictive models of the relationships between population size and damage to transplants and to determine in advance the level of population reduction required to give acceptable plant protection.

Although the main elements of management of restocking pests is now concentrated within the IFM programme, tools for direct intervention are still required when population levels of *H. abietis* are predicted to exceed the damage threshold. For example, insect parasitic nematodes are being used to reduce populations of *H. abietis* breeding in the stumps of conifer crops. This project includes development of systems for rearing large quantities of nematodes (in partnership with CABI), methods for application to stumps and assessment of efficacy in field use. A total of 66 ha was treated with nematodes during 2000 and a reduction of up to 68% in *H. abietis* populations was achieved.

Permethrin, the currently approved insecticide used to protect transplants, will be phased out by 2003. This has led to an urgent programme to assess the efficacy of alternative active ingredients. Two pyrethroid insecticides, alpha-cypermethrin and lambda cyhalothrin, offer promise and are being investigated further to provide the data necessary for registration through the Pesticides Safety Directorate.

We have started a new phase of the programme to assess the impact of green spruce aphid, *Elatobium abietinum*, on growth of spruce. Studies are now concentrating on pole stage trees, using permanent scaffold towers to make accurate counts of aphid populations and tree growth parameters such as needle biomass, shoot lengths, tree height and tree diameter. By using insecticide fogging to keep some trees free from aphid attack, it will be possible to compare directly the effects of presence or absence of aphids. The experimental plots have been located at different altitudes to provide links to climatic variables, thus allowing data to be assessed against climate change predictions.

Methyl bromide is widely used as a pre-shipment or remedial treatment to kill pest organisms in wood or wood products moved internationally. Under the Montreal Protocol, this ozone-depleting gas will be phased out over the next decade. This programme, partially sponsored by the EU in collaboration with the Central Science Laboratory (CSL), Applied Plant Research Institute in the Netherlands and Enterprise Ireland (IE), is looking at alternatives to methyl bromide for quarantine treatment. We are concentrating on developing reliable methods for heat treatment of bark using natural composting processes. Unlike full composting, which takes weeks or months to complete, the use of the process for quarantine purposes is concerned with time scales as short as one week. Results from trials carried out during the past year, indicate that it is possible to reach temperatures in excess of 60°C in 2–5 days but this is not sustained throughout a compost heap.

Methods are being developed to improve the ability to reach lethal temperatures without the need for turning the composting bark. Other measures being investigated in collaboration with CSL include alternative active ingredients for fumigation and development of temperature indicating systems for use within heat treatment chambers.

Forest Research has played a leading role in gaining approval, as a commodity substance, of disodium octaborate tetrahydrate (DOT) for stump treatment against Fomes root and butt rot. The change from urea to DOT will result in large reductions in pesticide usage within the FC, because much lower doses of DOT provide effective treatment compared with urea. The process has also stimulated a review of the quality of the application systems fitted to harvesters. Various components have been identified where significant improvements can be engineered which would improve the quality of application and at the same time reduce pesticide wastage. In addition, the assessment of risk posed by Fomes (*see Forest Research Annual Report and Accounts 1999–2000*) has led to a reappraisal and rationalisation of the areas of forest where treatment is required.

Forest health

Since 1987 changes in the condition of five forest tree species have been monitored by annual assessment of a network of permanent observation plots distributed throughout the UK. In 2000, a total of 8376 trees was assessed comprising five species: Sitka spruce, Norway spruce, Scots pine, beech and oak. A marked deterioration in the condition of common beech was largely attributable, as in previous cases of decline in 1990 and 1995, to heavy mast production. Levels of damage from insects (particularly *Rhynchaenus fagi*) and fungi on beech were similar to those recorded in 1999. Changes in the condition of both Norway spruce and Sitka spruce were minor, the latter having yet to recover fully from severe defoliation by *E. abietinum* in 1997. A slight improvement in Scots pine reflected the low incidence of attacks by both the pine shoot beetle

Tomicus piniperda and the defoliating fungus *Lophodermium seeditiosum* in 2000. The condition of oak also improved, with damage by insects such as *Operophtera brunnata* and *Erranis defoliaria* being frequent but less severe than in recent years.

Pathogens: a fresh focus on Phytophthora

As part of an EU project, Forest Research has been investigating the cause of oak decline which is locally severe. Several different *Phytophthora* species were found associated with roots of oaks including one previously unknown in the UK. Pathogenicity tests showed some of the *Phytophthoras* were highly pathogenic to the fine roots or bark of native oak trees and these are probably playing a significant role in the die-back of oak under certain soil conditions. This rising profile of *Phytophthoras* as tree pathogens has been highlighted recently by the discovery of another new, aggressive *Phytophthora* causing sudden death of oaks in California. The potential threat this pathogen could pose to oaks in the UK has been analysed in a Pest Risk Analysis, and FR's Mycologist (Clive Brasier) recognised it as being highly similar, if not identical, to a *Phytophthora* recently found on rhododendron in parts of Europe.

Environmental monitoring

A demonstration project applying modelling at a physiological level to the Intensive Forest Health Monitoring Network has been completed. The study has been augmented by the measurement of net ecosystem carbon flux, litter-fall analysis, and understorey leaf area and biomass determinations to provide carbon inventory datasets for the validation of the process model, ForestFlux.

The assessment and development of best management practice for the protection of the freshwater environment continues to be an important area of work. One major output was a review of all of the available guidance on pollution prevention in UK forestry. This has now been published by the Environment Agency.

Lowland forests have generally been viewed as protecting groundwater quality from major agricultural pollutants such as nitrate and pesticides. However, recent measurements of drainage water quality beneath a Corsican pine stand in Clipstone Forest, Nottinghamshire have suggested that this may not always be the case. Further studies are under way to investigate high nitrate levels recorded in the upper soil at this site.

Trees and archaeology

The cultural heritage of Britain is a finite resource and we have undertaken research into the conservation of sites of archaeological importance. This work will allow more site-specific guidance on site management and advice on the potential implications of woodland establishment for archaeological remains.

Biodiversity assessment

Findings from the Biodiversity Assessment programme were presented to a major seminar of policymakers and forest managers in November 2000. The results will be made available to a wider audience in a Technical Paper, currently in preparation and due for publishing in 2002. The assessment programme has provided a sound baseline and revealed substantial biodiversity in Britain's planted forests. For example, a number of rare fungi, normally associated with semi-natural pinewoods, have been found to have colonised Sitka spruce stands. The findings have confirmed the value of several practical methods for improving biodiversity, and further analyses of the data are expected to provide reliable indicators of biodiversity.

We jointly organised two major conferences - on the Restoration of Forested Landscapes and on Deer and Biodiversity. Papers from the former are being prepared for publication as an FC Technical Paper, while those from the latter will be published as a special issue of the journal *Forestry*.

Silviculture and biodiversity: the Scots pine study

A 3-year EU funded project on 'The silviculture and biodiversity of Scots pine forests in Europe' which involved 21 participants from 11 European states was concluded. Scots pine forests are widely distributed throughout the EU, making up over 20% of the commercial forest area. During the last century, the overriding objective of silvicultural practice in this forest type was timber production which resulted in shorter rotations and more uniform and single species stands. This led to a loss in biodiversity, particularly where stands of old trees with abundant deadwood were brought under this management system.

Recent changes in forest policy in the various member states are leading to more 'natural' management systems with longer rotations, more mixed stands and greater use of natural regeneration. Despite these changes in forest structure, there was no evidence of serious effects in recent times upon genetic diversity in Scots pine, largely because of the safeguards provided by EU regulations on Forest Reproductive Materials. Reviews of both invertebrate and vegetation species associated with Scots pine forests suggested that there were no bioindicators that could be used operationally as surrogate measures of biodiversity at a Europe-wide scale. However, recently developed measures of stand structure and tree species composition could be used for this purpose. Such measures can be quantified and linked to tree growth models and so provide methods of evaluating alternative stand management strategies and their potential impact upon biodiversity.

Direct seeding

Direct seeding is an alternative silvicultural system in which tree seed is sown directly into the site intended for woodland creation. It has a number of potential advantages over conventional tree planting for new broadleaved woodlands. Through higher stocking rates it allows selection for better quality timber, gives a more rapid establishment of

a woodland environment, utilises farm scale techniques and machinery, is cheaper in some circumstances and may offer a means of reducing herbicide inputs. Woodland stands resulting from direct seeding tend to have a variety of spacings and randomly occurring open space, similar to that advocated for new native woodlands.

Disadvantages include unpredictability of germination, and a limited number of site species combinations. Experimentation has highlighted the importance of good weed control, protection and seed pretreatment. Detailed silvicultural prescriptions and recommendations will be published later this year. Investigations are continuing into fate and depredation of tree seed, quantification of possible reductions in herbicide use, the potential use of the technique for linking up existing areas of ancient semi-natural woodland and the use of direct seeding for restocking.

Alternatives to clearfelling

Work on alternatives to clearfelling (ATC) has led to a new FC Information Note on *Transforming even-aged conifer stands to continuous cover management*, and large scale ATC trial sites have been established on the FE estate.

Substantial effort during the year was given to supporting new initiatives introducing continuous cover forestry (CCF) to conifer plantation forests in various parts of Britain. An outline framework for classifying sites for their suitability for CCF was developed in conjunction with a User Group of Forest Enterprise and private sector managers. This guidance gives particular emphasis to potential stand vulnerability to windthrow, possible vegetation competition to regeneration and species suitability for the site based upon Ecological Site Classification (ESC). This is to be published as a FC Information Note. Other studies have been undertaken to investigate appropriate monitoring systems for stands being managed under CCF and support was given to training events on CCF in Wales, Scotland and England.

Social forestry

A seminar on Social Forestry was held at Alice Holt in December 2000. This brought together staff from across the FC, academics and landowners to discuss issues of current importance in relation to people and woodlands. Presentations set out the position and needs of FE, FC and FR and were followed by workshop discussions covering topics such as Social Sustainability, Stakeholder Analysis and Quality of Life. A major conference has been organised for June 2001 at Cardiff University on Social Science Research into Woodlands and the Natural Environment.

Forest design planning

A major initiative during the year was the development of a prototype decision framework for public involvement in forest design planning. This was the result of collaborative research with Dr Mark Twery of the Northeastern Research Station of the USDA Forest Service, whose three month stay in Britain was part funded by the Scottish Forestry Trust. The overall aim of the work was to provide forest managers with guidance to help them select appropriate tools for involving the public in their forest planning process. The framework involves three primary elements: a system to allow managers to assess which stakeholders should be involved; a flowchart to help managers to determine when the stakeholders should be involved; and a description of the appropriate tools to use according to the level of stakeholder involvement. The decision framework has received a favourable response when presented at training events for staff of Forest Enterprise and other countryside bodies. We aim to develop this framework further in the coming year and see it as one way of ensuring consistency of effort from staff involved in public consultation on forest design and of enhancing the likelihood of successful outcomes.

Log straightness surveys

Further surveys of Sitka spruce log straightness have been carried out in northern England and northern and western Scotland. The results agree

with those from south Scotland which we reported last year, namely that trees in stands planted in recent decades and at higher elevation are less straight than those planted in earlier decades or at lower elevations. Since log straightness is an important measure of quality influencing conversion rates at the sawmills, the implications are of importance for the timber processing sector. Work is now in hand to elucidate the causal reasons for this change.

Interactive yield models

A version of the Sitka spruce interactive yield models for forecasting timber production in Sitka spruce stands has been released for evaluation by selected users from industry, research and commercial organisations. The advantages of the new model are a comprehensive mathematical description of Sitka spruce growth, the ability to respond dynamically to a wide range of alternative silvicultural prescriptions, the capacity to forecast development and yield in stands managed on long term retentions and the capability to provide predictions of volume out-turn in terms of specified product assortments. The response from reviewers has been positive and commercial release of the software package is planned.

Recent collaboration between Mensuration Branch, Silviculture (North) Branch and a visiting senior researcher from New Zealand, Mr Leith Knowles, has provided the opportunity to evaluate a decision support system for Douglas fir stand management. The original system was developed in New Zealand over the past nine years from data gathered from more than 1000 sample plots, mainly drawn from replicated silvicultural trials. It includes modules dealing with effects of site, silviculture and genetics on stand growth, log quality and sawn timber out-turn. Results so far are promising and the overall approach may prove to be an effective way of providing improved models for even-aged stands of Douglas fir in the UK.

National Inventory of Woodland and Trees

The National Inventory of Woodland and Trees (NIWT) has two sections – the survey of woodlands of 2 hectares or more and the survey of small woodland and trees covering woodlands of less than 2 hectares, groups of trees, belts of trees and individual trees. The digital map of woodland of 2 hectares and over for GB has been updated to a common reference date of 31/03/00, and the fieldwork for the survey of woodland of 2 hectares and over in GB was completed early in May 2000. Results for the final two Scottish Regions of the survey of woodland of 2 hectares and over have now been published. Analysis of the primary data from both surveys (> and < 2 hectares) was completed for all counties and regions in England and Wales. Summaries for Scotland, England and Wales, and county and region reports for England and Wales, will include the results of both surveys, and will be published over the next year. The results show the extent to which woodland area has increased over the last 20 years.

NIWT results showing woodland cover compared with the previous inventory.

Woodland cover (%)		
Country	Census of Woodlands and Trees Reference date 1980	National Inventory of Woodland and Trees Reference date 2000
Scotland	11.8	16.5
England	7.3	8.6
Wales	11.6	14.0
Great Britain	9.2	11.8

New private sector forecasts of softwood availability were produced for Wales and England using the latest data from the NIWT. The results were combined with Forest Enterprise forecasts, plus the previously prepared Scottish forecast, and an overall forecast for Great Britain was presented to the FC's Advisory Panel and subsequently published. The results show softwood availability in GB is set to increase by 50% over the next 20 years to just over 15M m³ per annum.

Advisory Committee on Forest Research

The Advisory Committee provides guidance to the Agency on the quality and direction of its research. The Committee met on two occasions and appointed two Visiting Groups of scientists to review the work of the Statisticians and of Woodland Ecology Branch.

The Visiting Group to the Statisticians was chaired by Professor Joe Perry from Rothamsted Experimental Station (BBSRC). The group found the quality of the statistical resource to be appropriate and acceptable, but was concerned over the sustainability of this level of achievement. They thus made a number of recommendations over the way that statistical services are provided and charged for and on the professional development of the statisticians. The majority of the recommendations are now being implemented.

The Visiting Group to Woodland Ecology Branch was chaired by Professor Brian Staines (retired Head of ITE Banchory). The group found 5 out of 7 programmes of research in the Branch to be comparable with the best international or UK standards with none of them being of an unacceptable standard. Specific comments were made on the need to allow time for writing up of research in peer-reviewed journals, the need for guidance to staff on publication requirements, the need to resource GIS work in the Branch, the lack of a professional ornithologist in the Branch and the advantages of getting sabbatical and similar non-FC staff to work in the Branch. Comments specific to individual programmes were also made and these will be of value to FC fundholders in commissioning research and to FR staff in future management of the Branch.

We are grateful to the members of the Advisory Committee and of the Visiting Groups for their valuable advice.

Finance

Income through the service level agreement with Policy and Practice Division declined by 2% to £9.8 million. Income from other parts of the FC including Forest Enterprise increased by 15% to over £1.4 million. Income from non-FC sources declined by 22%. Total expenditure declined by 2.5%. The target operating surplus of £519k was exceeded by £61k.

Total spending on capital was £587k which is over twice the rate of recent years. Major investment took place in IT equipment, refurbishment of laboratories, replacement of boilers and, in collaboration with CEH, gene sequencing equipment. Such investment is vital if Forest Research is to continue to carry out high quality, cost effective research.

Visitors

Both the Environment Subcommittee of the FC Advisory Panel and the FE Management Board met at Alice Holt during the course of the year. Many workshops were held either at the research stations or on forest sites. These included a one-day seminar on the new research programme on Social Forestry, and research updates for members of the Timber Growers Association and the Institute of Chartered Foresters. Seminar series with guest and Forestry Commission speakers were also hosted at Alice Holt and NRS. As part of the FC's programme of Technology Transfer, Technical Development Branch held several well-attended workshops at Aberfeldy and Inverness, in partnership with The Royal Scottish Forestry Society and Highland Birchwoods.

During the year we were pleased to have Dr Mark Twery of the USDA Forest Service, Leith Knowles of Forest Research (New Zealand) and Dr Thomas Jung of the Institute of Forest Botany (Munich) working with us as visiting scientists, as well as a large number of individual visitors and UK groups (MSc courses etc). The working meetings of a number of EU shared-cost projects were hosted and visitors from some 16 countries were welcomed to the research stations.

Targets and Achievements

Performance measure		1997/98	1998/99	1999/00	2000/01	
Customer satisfaction	Target	85%	92%	95%	96%	Target
	Achieved	90%	94%	96%	97%	met
Peer-reviewed papers	Target	29	35	38	43	Target
	Achieved	33	40	43	48	met
Unit cost/ research day 96/97 = 100	Target	98	96	94	94	Target
	Achieved	98	94	94	94	met
Unit cost of support services	Target	-	-	98	96	Target
	Achieved	-	100	98	96	met
Cost recovery	Target	100%	100%	100%	100%	Target
	Achieved	101%	103%	100%	101%	met

People

Total staff numbers employed by the Agency at year end excluding sandwich students and visiting scientists was 263 full-time equivalents, a reduction of 19 on last year.

I am pleased to record the award of an MBE in the Queen's Birthday Honours to Yvonne Samuel who had recently retired from the Official Seed Testing Station at Alice Holt. Professor Barry Gardiner of Silviculture (North) Branch was appointed Associate Professor in the Department of Wood and Forest Science at the Université Laval, Quebec. Dr Helen McKay and Dr Alvin Milner won the ICF Silvicultural Prize for their paper on 'Species and Seasonal Variability in the Sensitivity of Seedling Conifer Roots to Drying and Rough Handling'.

Dr John Gibbs OBE retired after more than 30 years service with the Forestry Commission, including 18 years as Head of Pathology Branch, during which time he worked on a wide range of tree pathogens including Dutch elm disease, *Phytophthora* diseases of alder and Fomes (*Heterobasidion annosum*). Dr Derek Redfern also retired from Pathology Branch after more than 30 years service during which time he worked on tree cankers, Fomes and blue stain pathogens. He was also a mainstay of the Disease Diagnosis and Advisory Service in the north and led the UK Forest Condition Survey. After more than 30 years with the Commission, Dr John Parker retired in Spring 2001. For 13 years he worked in Pathology

Branch, mainly on beech bark disease, then for 10 years as Technical Publications Officer responsible for a large and varied output of publications, and from 1992 as Head of Communications Branch.

In common with the rest of the Forestry Commission, Forest Research unified its labour force dropping the distinction between industrial and non-industrial staff. This change, as well as giving more opportunities for staff, is leading to savings through greater flexibility in the deployment of staff. Following unification the Forestry Commission, including Forest Research, was recognised as an Investor in People.

New appointments to the Agency included Dr Kirsten Foot who is working on land reclamation, Dr Jason Hubert to work on timber quality, Dr Elizabeth O'Brien to study the social impacts and benefits of forestry and Dr Roger Trout to work on protection of trees against mammals. We also appointed Mrs Alison Melvin as our Business Development Manager.

The success of the Agency in providing advice to policymakers, in equipping forest managers with improved methods and technical services and meeting key targets could not have been achieved without the skills, enthusiasm and commitment of the staff of the Agency.



Jim Dewar
Chief Executive, Forest Research