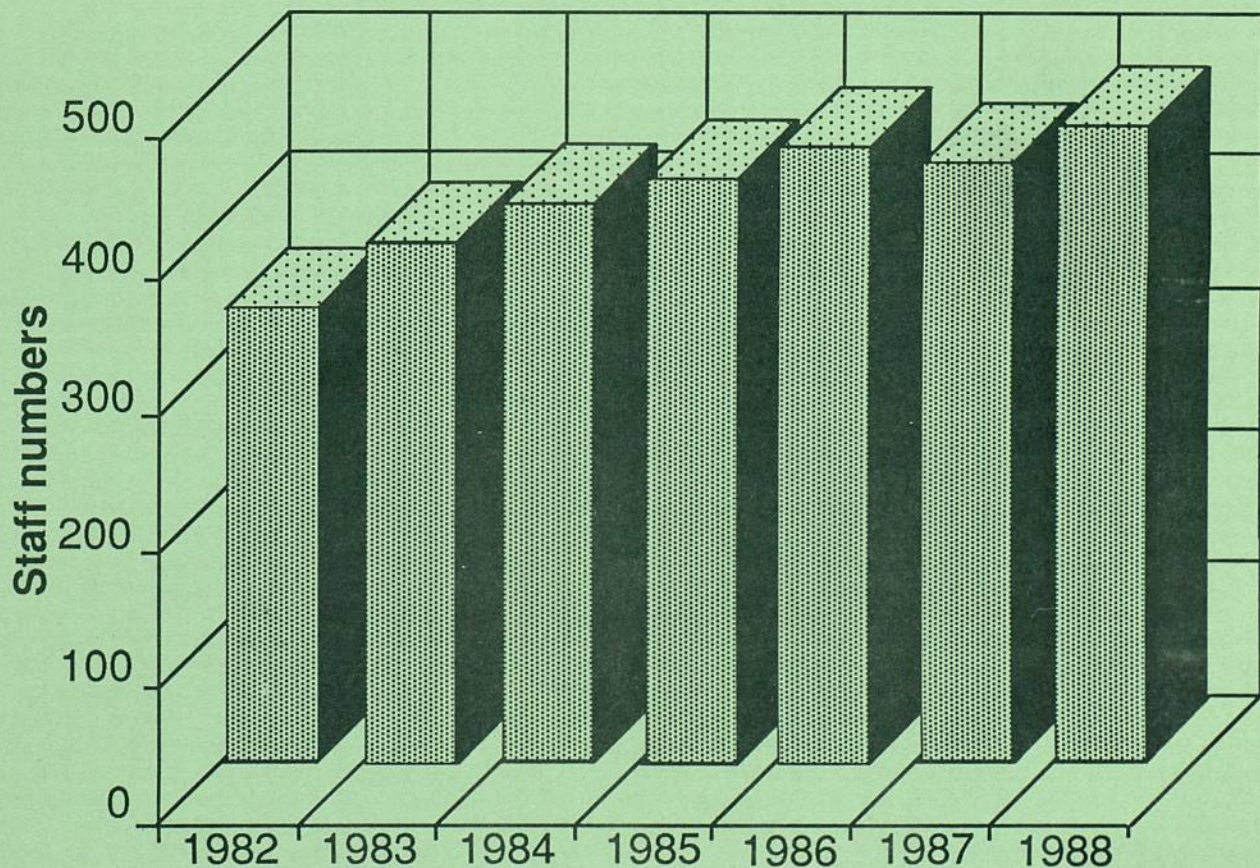




# Trends in Forestry Research 1982-1988

D.A. Burdekin



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TRENDS IN FORESTRY RESEARCH  
1982-1988

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# TRENDS IN FORESTRY RESEARCH 1982-1988

by **D.A. Burdekin**  
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## *Introduction*

Increasing interest in forestry in Britain has followed the search for alternative land uses to agriculture and the growing importance of conservation. Research requirements have adapted to this new situation. This paper looks at recent trends and seeks to ask whether resources are reasonably matched to requirements. At least seven public agencies are engaged in funding forestry research in Britain and a similar number actually undertaking this research. Information provided by the funding agencies has been collated from 1982-1988 in order that an analysis of trends in forestry research can be made. This collation has been done under the auspices of the Forestry Research Coordination Committee which was established in 1982 to promote better coordination of forestry research in Britain.

## *The Forestry Research Coordination Committee (FRCC)*

The FRCC was established by the Forestry Commission following a Select Committee enquiry which drew attention to the need for better coordination of forestry research including wood and wood products. The FRCC includes representatives from the following organisations, all of which fund, to various extents, forestry research:

Agriculture Departments (including Ministry of Agriculture and Department of Agriculture and Fisheries for Scotland) — interests in farm forestry;

Agriculture and Food Research Council — interest in farm forestry;

Department of the Environment — interest in wood science, arboriculture and environmental research;

Forestry Commission — all aspects of forestry research;

Nature Conservancy Council — interests in conservation;

Natural Environment Research Council, both as source of university grants and funding agency for research institutes — biological aspects of forestry research;

University forestry departments — wide interests in forestry research.

There are also a number of other public and private organisations which fund research on forestry including the Department of Energy, the European Economic Community, the Science and Engineering Research Council, the Economic and Social Research Council, the Scottish Forestry Trust, the Forestry Management Companies, etc.

The terms of reference for the Forestry Research Coordination Committee are as follows:

- a. to identify and define forestry research needs and opportunities;
- b. to advise on research requirements and priorities in relation to the needs and opportunities identified;
- c. to stimulate research in forestry, the exchange of information and collaboration between research organisations and individuals and the publication of research findings;
- d. to encourage the financing of identified research proposals.

## *Collation of data*

An annual summary of forestry research projects is made. The basic data provided includes funding agency, subject area, annual resource allocation (as non-industrial staff time or 'effort' and cost), Project title, Project Description.

The funding agency was one of the primary categories in the collation, rather than the research contractor. This approach was taken on the basis that the funding agency has ultimate responsibility for the allocation of resources.

As forestry research covers such a wide range of subjects it has been divided into nine subject areas. The definition of subject areas is inevitably somewhat arbitrary but it has, nevertheless, provided a useful breakdown of forestry research for subsequent analysis. The following subject areas were selected:

- I Genetics and tree improvement (to include research on seed, selection, breeding, progeny and clonal testing);
- II Tree biology (to include research on tree physiology and mycorrhizas);
- III Silviculture (to include plant production, cultivation, establishment, tree stability, soils and nutrients, and arboreta);
- IV Biotic damage (to include fungal and viral pathogens, vertebrate and insect pests);
- V Biomass production (to include distribution of dry matter within and between trees, competition studies, and basic physical properties of tissues);
- VI Harvesting techniques (to include harvesting of stems, roots, branches and leaves);
- VII Wood science and processing (to include technical properties of wood utilisation development);
- VIII Environmental effects (to include wildlife conservation, recreation, landscape, water and air pollution);
- IX Forest planning (to include application of technical forestry knowledge for management of forests including relations with other land users).

The allocation of projects to any one of the nine subject areas has not proved particularly difficult. Perhaps surprisingly, it has proved more difficult on occasion to determine whether a project was relevant or not to forestry. Particular examples of this will be quoted later and it will be seen that judgements of this relevance at different times can influence the analysis of trends. The inclusion of air pollution alongside conservation in subject area VIII may appear anomalous but both are considered to be environmental topics.

The allocation of resources to projects, either in terms of staff time or costs, is a large topic in its own right and a pragmatic approach has been taken in this analysis. The primary record in most research institutes used for project costing is time spent by researchers on each project. This is converted to cost (desirably though not always) taking account of staff salaries, associated overheads and equipment costs. In this particular study, the calculation of project costs is based on the costs of all non-industrial staff. It should be noted that staff in research organisations wholly engaged in education and training are excluded from the statistics.

Much forestry research is carried out in research institutes and funded by their parent organisations — e.g. NERC's Institute of Terrestrial Ecology, Forestry Commission Research Stations, DOE's Building Research Establishment and AFRC Institutes. However several departments or agencies, including the Nature Conservancy Council, Natural Environment Research Council and the Department of the Environment, commission a significant proportion of their research by contract or grant to others. NERC also undertakes much research under contract to others. In these cases it is relatively straightforward to identify both the total financial commitment and the non-industrial staff input. One qualification which should be mentioned in this context relates to research council and other university studentships. These are awarded on the basis of dual

funding, i.e. the research council grant is complemented by the university providing, for example, bench space and facilities. This element of funding is difficult to quantify and has not been included in this collation.

Wherever possible a note is kept of the contractor as well as the funding agent, e.g. the university department is noted for research council awards.

## *General results*

The annual progression of estimated staff numbers and expenditure is shown in Figures 1 and 2 respectively. Tables 1 and 2 set out the results in detail. Records of staff numbers were kept for the period 1982-88 whereas those for expenditure were not started until 1985.

It is clear from both figures that both staff numbers and expenditure on forestry research have increased. No adjustment has been made in the expenditure figures for inflation over this period. The so-called GDP deflator (index of producer prices) for the period 1982-1988 shows a steady annual increase between 5 and 6 per cent. Between 1982 and 1987 an index of costs in the Forestry Commission showed similar ratios of increase to the general level of prices in the economy assessed by the GDP price deflator. Since 1987, certain groups of staff have had substantial real increases in salaries, leading to a real increase in costs of the order of 2 per cent.

The total estimated expenditure on forestry research in 1988 was £16 million of which 45 per cent was spent by the Forestry Commission, rather less than 15 per cent each by the Agriculture Departments, DOE and NERC, and smaller proportions by NCC, university forestry departments and others (see Figure 3). Figure 4 shows that the largest subject area was silviculture and this accounted for an estimated 27 per cent of the cost; other large areas included environmental effects (18 per cent), biotic damage and wood science (13 per cent each), tree improvement, tree biology (10 per cent each).

## *Detailed results*

Detailed results showing estimates of non-industrial staff numbers over 7 years, classified by funding agency and by subject area are given in Tables 1 and 2 respectively. Parallel information on costs over 4 years is given in Tables 3 and 4 (comparable information on costs was not available over the 7 year period). Over the four comparable years (1985-1988 inc.) the upward and downward movements of staff numbers and costs follow broadly similar trends. The cost per man year shows considerable variation across funding agency. The least costly is the university studentship (£8m per annum in 1988) and even if the dual funding arrangement (referred to earlier) for research council grants were included, research training awards would still be the lowest cost research. The highest cost is associated with research institutes (£40-60m per annum) where the salaries are greater and there is a substantial overhead element including buildings and support services.

The small horizontal lines included in Tables 1-4 mark the positions where research, previously in progress but not previously thought relevant, should be included. For example in Table 1, the DOE figures for 1982 and 1983 for staff numbers were 19.9 and 41.2. This did not represent an increase in the effort devoted by DOE to forestry research but reflected a decision that research projects in progress and largely concerned with imported wood at the Princes Risborough Laboratory were relevant to British timber and should therefore be included. Other, less significant changes marked by horizontal lines can be seen in Tables 1-4 and these represent changes in views of the relevance to British forestry of research already in progress.

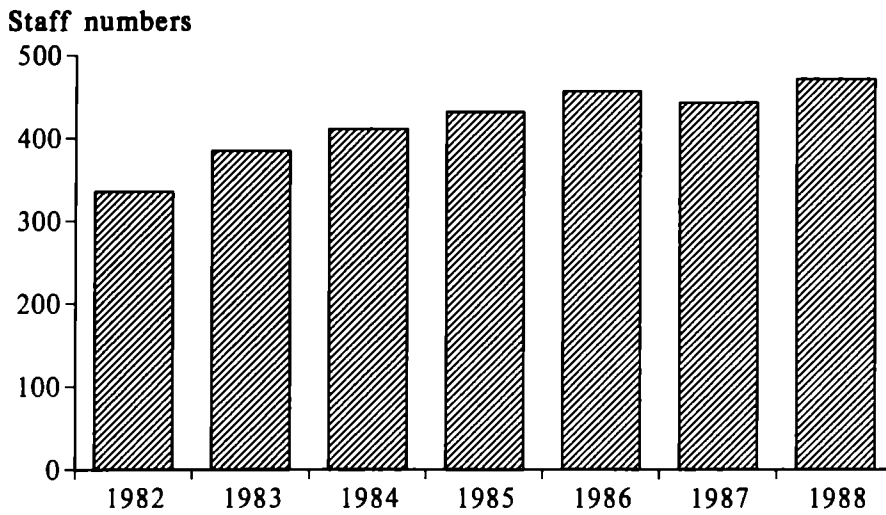


Figure 1. Estimated staff numbers 1982-88.

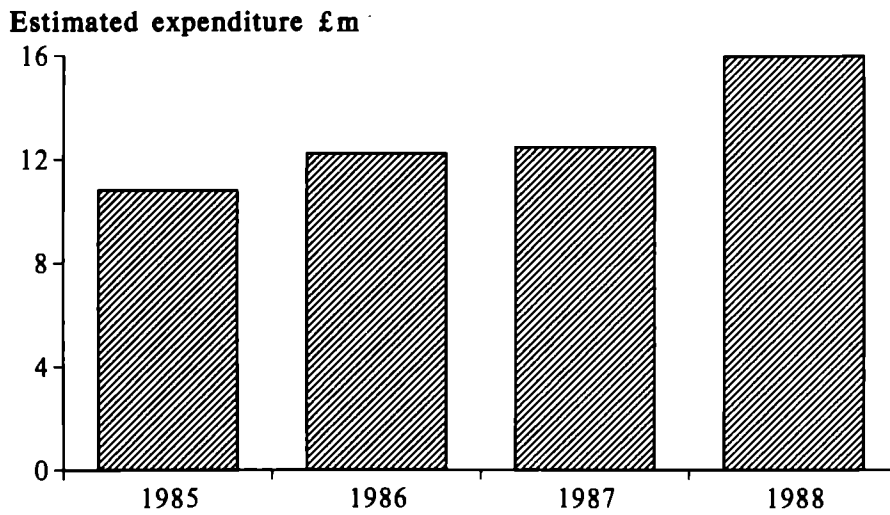
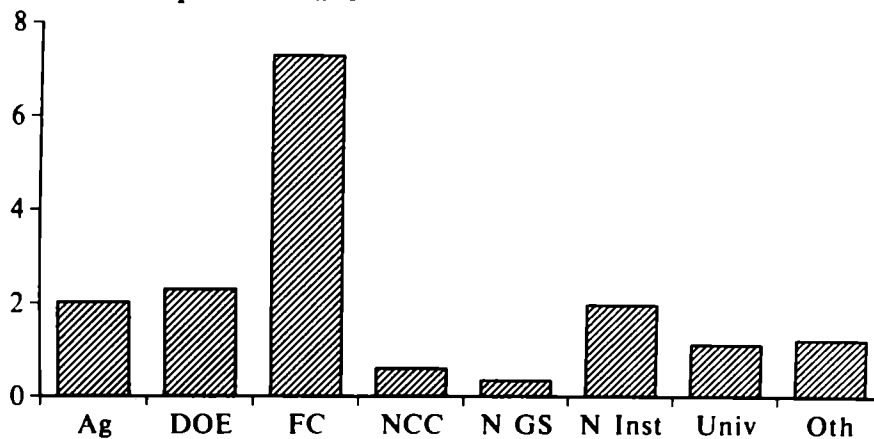


Figure 2. Estimated expenditure (£m) 1985-88.



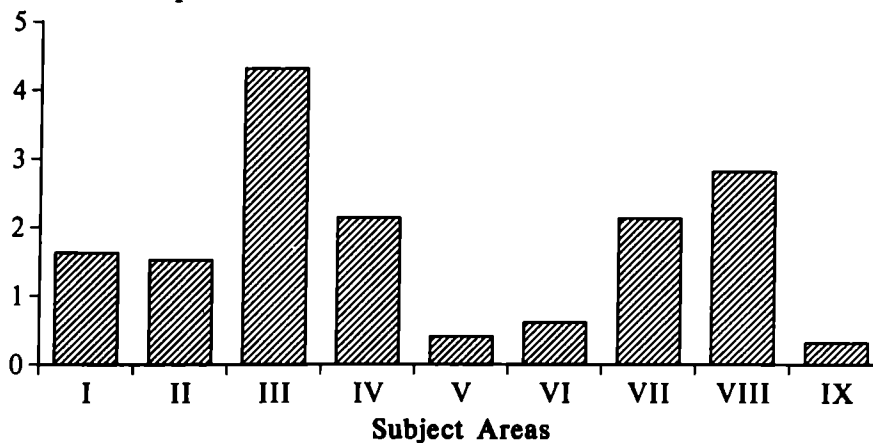
**Estimated expenditure £m**



**Figure 3. Expenditure (£m) by funding agencies in 1988.**

Ag = Agriculture Departments  
N GS = NERC (grants and studentships)  
N Inst = NERC (Institutes)  
Univ = University Forestry Departments  
Oth = Others

**Estimated expenditure £m**



**Figure 4. Expenditure (£m) in subject areas I-IX in 1988.**

**Table 1 Estimates of non-industrial staff numbers funded by member organisations over 7 years**

|      | Ag. Depts  | DOE  | FC           | NCC  | NERC G&S | NERC Inst. | Univ For.   | Others | Total |
|------|------------|------|--------------|------|----------|------------|-------------|--------|-------|
| 1982 | 3.0        | 19.9 | <u>138.1</u> | 13.5 | 46.5     | 73.9       | <u>24.2</u> | 16.4   | 335.5 |
| 1983 | <u>2.0</u> | 41.2 | 145.9        | 18.9 | 56.5     | 73.7       | 16.6        | 29.7   | 384.5 |
| 1984 | 14.4       | 40.2 | <u>153.0</u> | 17.7 | 64.3     | 73.4       | 16.1        | 31.8   | 410.8 |
| 1985 | 10.3       | 62.5 | 161.8        | 17.8 | 66.9     | 60.9       | 12.2        | 38.5   | 430.9 |
| 1986 | 16.1       | 64.6 | 162.6        | 23.9 | 62.8     | 63.5       | 5.5         | 56.8   | 455.8 |
| 1987 | 20.8       | 51.8 | 167.7        | 42.0 | 45.3     | 52.3       | 5.5         | 56.4   | 441.8 |
| 1988 | 56.2       | 45.0 | 169.3        | 32.8 | 40.4     | 50.5       | 10.1        | 64.5   | 470.1 |

**Table 2 Estimates of non-industrial staff numbers by subject area over 7 years**

|      | I    | II   | III   | IV   | V    | VI   | VII         | VIII  | IX   | Total |
|------|------|------|-------|------|------|------|-------------|-------|------|-------|
| 1982 | 40.8 | 34.2 | 89.5  | 66.8 | 16.7 | 9.0  | <u>23.0</u> | 44.0  | 11.5 | 335.5 |
| 1983 | 36.3 | 41.6 | 90.7  | 75.4 | 12.7 | 8.0  | <u>58.0</u> | 47.6  | 14.2 | 384.5 |
| 1984 | 39.1 | 56.5 | 94.1  | 81.4 | 13.8 | 8.0  | 57.9        | 45.4  | 14.6 | 410.8 |
| 1985 | 40.5 | 57.6 | 85.3  | 73.6 | 18.3 | 8.0  | 60.0        | 71.4  | 16.3 | 430.9 |
| 1986 | 33.5 | 63.3 | 104.7 | 70.4 | 14.5 | 11.1 | 61.6        | 84.7  | 12.0 | 455.8 |
| 1987 | 26.9 | 55.6 | 101.2 | 60.7 | 13.0 | 15.1 | 45.0        | 102.9 | 21.4 | 441.8 |
| 1988 | 40.7 | 61.2 | 116.2 | 59.7 | 9.5  | 15.1 | 51.0        | 100.3 | 14.9 | 470.1 |

**Note:**

Horizontal lines within columns mark positions of administrative changes, e.g. research already in progress but for a variety of reasons not previously included.

**Table 3 Estimates of costs (£m) by organisations over 4 years**

|      | Ag. Depts | DOE   | FC    | NCC | NERC G&S | NERC Inst. | Univ For. | Others | Total  |
|------|-----------|-------|-------|-----|----------|------------|-----------|--------|--------|
| 1985 | 335       | 1,963 | 5,415 | 316 | 447      | 1,953      | 94        | 277    | 10,800 |
| 1986 | 568       | 2,161 | 5,684 | 345 | 475      | 2,136      | 62        | 815    | 12,240 |
| 1987 | 711       | 2,402 | 6,014 | 554 | 310      | 1,793      | 55        | 636    | 12,475 |
| 1988 | 2,013     | 2,296 | 7,326 | 609 | 342      | 1,977      | 113       | 1,231  | 15,957 |

**Table 4 Estimates of costs (£m) by subject area over 4 years**

|      | I     | II    | III   | IV    | V   | VI  | VII          | VIII  | IX  | Total  |
|------|-------|-------|-------|-------|-----|-----|--------------|-------|-----|--------|
| 1985 | 1,125 | 1,089 | 2,687 | 1,808 | 548 | 288 | 1,606        | 1,478 | 171 | 10,800 |
| 1986 | 1,079 | 1,325 | 3,388 | 1,864 | 407 | 396 | <u>1,715</u> | 1,854 | 211 | 12,240 |
| 1987 | 949   | 1,160 | 3,349 | 1,755 | 395 | 459 | 1,910        | 2,242 | 257 | 12,475 |
| 1988 | 1,630 | 1,528 | 4,322 | 2,139 | 413 | 614 | 2,127        | 2,813 | 320 | 15,957 |

**Note:**

In 1987, DOE at BRE changed the attribution of costs to staff, hence the costs below the bar in subject area VII are artificially raised.

## *Discussion of trends 1982-88*

There are a number of trends in the direction of forestry which can be identified within Tables 1-4. Two broad headings for a discussion of these trends are Funding agencies and Subject areas.

### **Funding agencies**

#### *Agriculture Departments*

Before 1984 the Agriculture Departments provided minimal support for forestry research. However, even at that time there was interest in agroforestry, that is, the joint use of the same land for farming and tree growing. It was in 1984 that some of the first large-scale experiments were established and the relevance to forestry of some research on fruit trees was recognised. An increase in research interest by the Agriculture Departments can therefore be seen in 1984 but a much larger increase occurred in 1988 following changes in policy on agricultural production and alternative land uses. Considerable resources were then made available for research on farm forestry, that is, forestry on previously agricultural land. A major part of this increased expenditure was committed to the selection and improvement of broadleaved trees, especially involving new techniques of genetic manipulation.

#### *Department of the Environment*

The Department has a twofold interest in forestry research. DOE funds research at the Building Research Establishment (previously sited at Princes Risborough) on wood science. Other policy directorates in the Department finance contracted research in the environmental sector, including air and water pollution and arboriculture.

Reference has already been made to the additional research on wood in 1983. However the increase between 1984 and 1985 from 40.2 to 62.5 staff reflects a marked increase in support for research on the effects of air pollution on trees. This increase in support for research on air pollution was part of a wider study of air pollution made by the Department.

#### *Forestry Commission*

Forestry Commission expenditure on forestry research over the past 8 years has risen partly because of the inclusion of mensuration research and partly by an increase in commissioned research. This (the latter) has enabled the Forestry Commission to fund research, especially in the wood science and conservation areas where it has limited in-house expertise. At the same time there have been changes in the balance of the programme with increases in air pollution and conservation and a reduction in some aspects of silvicultural research.

#### *Nature Conservancy Council*

The estimated financial support for forestry research by the Nature Conservancy Council (NCC) has doubled over 4 years (see Table 3). The estimates for non-industrial staff shown in Table 1 have also shown an overall increase, though two hiccoughs occurred in 1984 and 1988. There is no obvious reason for these declines in staff numbers though the increased expenditure in 1988 indicates that overall support has not diminished. As much of the NCC research is contracted, it appears that contractors have become more expensive.

#### *Natural Environment Research Council (grants and studentships)*

The figures in Tables 1 and 3 indicate some lessening of expenditure on forestry research over the period. This is not a result of a policy change but merely reflects the relative success of forestry projects seeking grant aid.

#### *Natural Environment Research Council (Institutes)*

Support for forestry research by NERC is concentrated in the Institute of Terrestrial Ecology but research relevant to forestry is also undertaken at the Institute of Virology, the Institute of Hydrology and at the laboratory of the Freshwater Biological Association. Following 3 years of steady support for forestry

research between 1982 and 1984 (Table 1) there has been some decline in staff numbers in subsequent years with the exception of 1986. The figures for expenditure (see Table 3) are similar except that the cost in 1988 has increased. The broad downward trend reflects a change in NERC policy in the mid 1960s to reduce NERC support for research at its institutes in order to provide more finance for universities. Institutes were therefore pressed to find outside support for research.

### *University Forestry Departments*

This category has not in practice proved particularly significant as universities do not have many resources at their own disposal and rely largely on grant-giving bodies to fund their research. Some information on university sponsored grants and on supervisory time was obtained but the overall upward trend was more an improvement of current expenditure rather than a real increase.

### *Others*

There has been an increase in support for research by Others over most of the 7 year period. Much of the information for this category is obtained from University Forestry Departments although there have been small but significant contributions from NERC, SERC, Scottish Forestry Trust and others. The initial increase seen between 1982 and 83 (Table 1) was probably due to a better provision of information. The increase between 1985 and 86 was caused by a new programme of research funded by the Department of Energy through their Energy Technology Support Unit (ETSU). At that time the government mounted a series of studies on alternative sources of energy and 'woody biomass' was one.

## **Subject areas**

### *I Genetics and tree improvement*

The figures in Table 1 indicate that research on genetics and tree improvement was maintained at a steady level from 1982-85, fell in 1986-87 and rose again sharply in 1988. The main contractors for this research in the early years were NERC, ITE and the Forestry Commission. However, support by AFRC for research on tree improvement at the AFRC Institute of Horticultural Research in this area was revived. This programme is largely directed to research relating to farm woodlands.

### *II Tree biology*

Research in this area covers many diverse aspects of tree physiology including studies of mycorrhizas. Trends mirror fairly closely those in Area 1 and largely for the same reasons relating to a reduced NERC support and an increasing MAFF interest. However, the trends are less marked and the NERC interest has been more strongly maintained.

### *III Silviculture*

This is the largest subject area (see Tables 2 and 4) and it represents the largest bulk of applied research in forestry. The major contractor is the Forestry Commission which undertakes wide ranging research on many aspects of the planting and tending of both broadleaved and coniferous forests. The Forestry Commission support for research has remained steady over the 7 year period. The increase in research in 1986 was largely due to a boost in funding of the programme on short rotation biomass crops supported by the Department of Energy. The increase in 1988 is largely attributable to increased support from the Agriculture Departments for research on farm woodlands.

### *IV Biotic damage*

Biotic damage encompasses research on damaging agents ranging from fungi and insects to vertebrate pests. Steady support for research has been provided by the Forestry Commission but the grants and studentships at universities have fallen in the last few years. This has resulted in a decline in support over the past 4 years (see Table 2). The reason why university grants have fallen is unclear though permanent staff at some of the universities with expertise in this area have not been replaced following retirement. There may also have been

some reduction in the occurrence of serious pest problems, e.g. the ravages of Dutch elm disease have now passed their peak.

#### *V Biomass production*

This was originally included to identify research on the measurement of tree growth, particularly in relation to yield prediction. This is clearly an important topic and research effort, though small, has fluctuated and shown some decline in 1988.

#### *VI Harvesting techniques*

Research on harvesting has not been a major topic for research in Britain as much research on harvesting machinery is undertaken in countries with a far larger forest industry. There was a modest increase in research during 1986 and 1987 largely due to an interest by the Department of Energy in developing harvesting machines for very short rotation crops.

#### *VII Wood science*

The large increase in support for research between 1982 and 1983 has already been referred to following a reappraisal of the relevance of the research programme at Princes Risborough Laboratory (PRL). Research at PRL includes studies of the properties of British timber, particularly in relation to sawn wood. It also includes a variety of studies of the processing and finishing of wood which relate perhaps equally to imported and British timber. This programme included a study of wood in timber framed housing, a topic of major concern in the early 1980s. These studies were concluded in 1986 and the fall in support seen in Table 2 in 1987 was largely as a result of this. The modest increase in research in 1988 was due to increased support at universities supported by a number of different interests. Research on pulp, paper and particle board has not been included as this is largely funded on an international scale by commercial interests.

#### *VIII Environmental effects*

Research has increased more than twofold during the 7 year period, a larger increase in both real and proportional terms than in any other subject area. It includes a diverse range of topics including all aspects of conservation and of pollution. The NERC Institute of Terrestrial Ecology has consistently provided substantial support for research in this area. The marked increase in research in 1985 was largely due to a strong interest by DOE in pollution research, especially air pollution but also water pollution. In 1986 there was a further marked increase, due to increased funding by NCC and FC for commissioned research on conservation. A further increase in 1987 was mainly a result of additional support from NCC for a wide range of conservation topics. This subject area has become second in size to silviculture and is likely to maintain this position as long as interest is maintained in wildlife conservation and environmental pollution.

#### *IX Forest planning*

This is a relatively small subject area and limited support is provided by the Agriculture Departments, the Forestry Commission and a range of other customers. The FRCC has reviewed by means of expert review groups research programmes in the majority of areas and a number of recommendations have been made and followed through. The review of forest research on economics felt that there was little coordinated research on economic aspects of planning and this is perhaps clear from the low level of support.

## **General conclusions**

Forestry research is unusual, at the present time, in being an example of where research is expanding. There are several reasons for this. Forestry is a useful alternative to agricultural crops in surplus. The forest industry is expanding, new land is being planted and industrial usage is growing. At the same time environmental concerns, including both pollution on the one hand and wildlife conservation on the other, have grown significantly in recent years. Research effort has increased in response to government and public concern and much of the support has come from government agencies (e.g. DOE and NCC) responsible for major research programmes in these areas.

