

Progress through  
partnership

AGRICULTURE, HORTICULTURE  
AND FORESTRY



FIRST REPORT

Office of Science and Technology

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# FOREWORD

The UK Technology Foresight Programme is a systematic, ongoing process for assessing those scientific and technological developments which could have a strong impact on industrial competitiveness, wealth creation and quality of life in the next 10-20 years. It also aims to stimulate and foster partnerships between scientists, engineers and technologists in academia and industry. In April 1995, the Technology Foresight Agriculture, Natural Resources and Environment (ANRE) Panel, whose remit included agriculture, horticulture and forestry published a report along with 14 other panels that together covered all of the UK industrial sectors [1](#). I remarked in its foreword on the tremendous range of activities covered, from farming to sea fisheries, coal mining to global warming and gave credit to the panel members representing these diverse interests for working together to come to a consensus. In our recommendations, we called for investment in research in key areas, better coordination of research and its feed-through into useful technology and more investment into public perception and understanding of new technologies.

We also recommended that in the subsequent phases of the Technology Foresight programme, consideration should be given to splitting the panel to give a more easily manageable focus. Our recommendations were acted upon and a new Panel covering the sectors Agriculture, Horticulture and Forestry held its first meeting in November 1995. This short report describes its progress to date. The Panel's second report, to be published early next year, will present in detail how we have continued the work that ANRE started in analysing priorities for its sectors and will report on our activities to encourage greater contact and collaboration between science and industry.

A handwritten signature in blue ink that reads "John R Hillman". The signature is written in a cursive style and is positioned above a horizontal line.

**Professor John R Hillman**





Chairman, UK Technology Foresight Panel on Agriculture, Horticulture & Forestry

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**1** Technology Foresight Progress Through Partnership, Vol ii, Agriculture, Natural Resources and Environment, 1995, HMSO



# FIRST REPORT

1. The Technology Foresight programme is a major Government initiative run by the Office of Science and Technology, part of the Department of Trade and Industry. The programme aims to promote wealth creation and a better quality of life in the UK by promoting a culture change whereby academia takes more notice of the relevance of its research to industry and companies take a longer term view of their businesses and consider how science, engineering and technology (SET) might help them to become more competitive. It is hoped that this will lead to much greater collaboration between public sector-funded research and the private sector
2. The programme started in the Summer Of 1994 with fifteen sectoral panels of experts drawn from industry, academia and Government. They worked to a common pattern and consulted widely to analyse the competitiveness and degree of SET involvement in their sectors. They then used the techniques described below and others to identify priorities for research and for changes in infrastructure. The panels took a long-term view, typically 10-20 years, and tried to come up with recommendations that, if adopted now, would make a positive difference over that time-scale.
3. The new Agriculture, Horticulture and Forestry (AHF) Panel aims to build on the work done in the first phase of the Technology Foresight programme by the Agriculture, Natural Resources and Environment (ANRE) Panel. Its current terms of reference are to:
  -  disseminate panel findings throughout the relevant industrial sector;
  -  develop networks and broker partnerships between industry and the academic sector;
  -  monitor progress with Research Councils and Government Departments;
  -  review panel recommendations in the light of community views.
4. To fulfill its remit, the Panel, whose membership is at [Annex 1](#), has taken the view that it needs to develop more direct messages and recommendations than was possible for the ANRE panel. It is therefore using the themes from that panel's report (whose recommendations relevant to this panel's sectors are at [Annex 5](#)) to analyse its sectors in more detail and thereby make them more relevant to the AHF communities: farmers; growers; foresters; those working in industries that supply or receive goods and intellectual property from the sectors; and the scientists and technologists working in areas relevant to these sectors.
5. The way the Panel has chosen to do this is to set up three sub-groups with membership representing major interests within each of the following areas:



Plant systems



Livestock systems



Forestry & wood products.

The sub-groups bring extra industrial and academic expertise to the work of the Panel (their memberships are given in Annex 1) and have a Panel member in the chair. They have used a common approach, the "Foresight process" outlined below, in tackling their work but have been in existence for varying lengths of time and so have reached different points in their deliberations. Progress reports from each of these sub-groups are annexed to this report (Annexes 2 to 4). The Panel will be considering these and further reports at its future meetings and will draw out the key issues in its second report to be published next year.

6. The Panel has also been monitoring the responses of Research Councils and Government Departments to the recommendations of ANRE. They have taken a very positive approach to the findings and have incorporated many of the priority topics into their strategic research programmes. Examples of where new initiatives have been set up to respond to Technology Foresight include new LINK programmes on horticulture (MAFF/BBSRC/DoE/DANI/SOAEFD), sustainable livestock production (MAFF/BBSRC/SOAEFD/DANI) and aquaculture (MAFF/NERC/SOAEFD). Further details are contained in the First Progress Report on the Foresight Programme.

## **The Foresight process**

7. The Foresight process consists of identifying the key drivers for a sector, those factors which are likely to be important over the timescale of 10 to 20 years. From these are developed a number of imagined scenarios of possible futures to aid "lateral" thinking and discussion. Current and future work within the sub-groups consists of defining the key drivers for each sub-sector by consultation with interested groups and then going on to identify and prioritise science and market needs.
8. The sub-group reports at Annexes 2 to 5 are descriptions of progress so far and of future plans. As background to their discussions, each sub-group is collecting together data on its sectors and each of the reports is prefaced by a brief description of primary production figures. In the second Panel report, the main Panel, and its sub-groups will present their conclusions and report on progress in promoting networks and partnerships between their academic and scientific communities and other activities to increase the awareness of and involvement in Foresight in industry.

9. As part of its discussions, the Panel. has been considering a paper entitled "A review of the role of agriculture, horticulture and forestry in the UK economy" by Professor John Marsh, a Panel, member and Director of the Centre for Agricultural Strategy, University of Reading. This review, which provides useful background information and analysis to these sectors, will be published by the Panel shortly.

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# ANNEX ONE

## MEMBERSHIP

### AGRICULTURE, HORTICULTURE & FORESTRY PANEL

<b>PROFESSOR JOHN R HILLMAN</b> (Chairman)	Scottish Crop Research Institute <i>Director of this institute researching all aspects of plant science related to crops; Deputy president of Mylnfield Research Services Ltd, a technology transfer company</i>
<b>DR JOHN BRAUNHOLTZ</b>	Horticultural Development Council <i>representing the interests of growers</i>
<b>DR TRICIA CHISHOLM</b>	The Wellcome Trust <i>with expertise in animal health research and the veterinary pharmaceutical industry</i>
<b>PROFESSOR JULIAN EVANS</b>	Forestry Commission <i>Chief Research Officer (South), Alice Holt Research Station</i>
<b>A BEN N GILL</b>	National Farmers Union <i>Deputy President</i>
<b>GEOFF HARRINGTON</b>	Meat & livestock Commission <i>representing the red meat industry (also chairs the Meat sub-group of the Food &amp; Drink Technology Foresight Panel)</i>
<b>PROFESSOR R BRIAN HEAP</b>	Babraham Institute <i>with expertise in animal science</i>
<b>PROFESSOR BRIAN J LEGG</b>	Silsoe Research Institute <i>Director of this institute researching all aspects of engineering and the physical sciences relevant to the agriculture and food industry</i>
<b>PROFESSOR BEN J MIFLIN</b>	Institute of Arable Crops Research, Rothamsted Experimental Station <i>Director of this institute researching all aspects of science relevant to arable crops</i>
<b>JUDY MACARTHUR CLARK</b>	Veterinarian <i>and chair of Farm Animal Welfare Council R&amp; D group</i>
<b>DR ROD MORROD</b>	Zeneca Agrochemicals
<b>PROFESSOR JOHN S MARSH</b>	Centre for Agricultural Strategy, University of Reading <i>Director of this centre with expertise in agricultural economics</i>
<b>J FRANK OLDFIELD</b>	Farmer; Home Grown Cereals Authority

<b>DR ROGER TURNER</b>	British Society of Plant Breeders <i>Chief Executive of this society representing the interests of plant breeding companies</i>
<b>JAKE VOWLES</b>	Agricultural Engineers' Association
<b>Assessors</b>	
<b>DR TERRY HEGARTY</b>	The Scottish Office Agriculture, <i>Environment and Fisheries Department Scientific Adviser</i>
<b>DR PENNY MAPLESTONE</b>	Biotechnology and Biological Sciences Research Council <i>Head of the Agricultural Systems Directorate funding research relevant to the agro-industries</i>
<b>DR CECIL H McMURRAY</b>	Department of Agriculture for Northern Ireland <i>Chief Scientist</i>
<b>DR JOHN SHERLOCK</b>	Ministry of Agriculture, Fisheries & Food <i>Head of Agriculture and Food Technology Division</i>
<b>DR MIKE TRICKER</b>	Natural Environment Research Council <i>Director of innovation; also a member of the Natural Resources and Environment Technology Foresight Panel</i>
<b>DR DAVID RAWLINS</b>	Office of Science and Technology <i>Secretary to the panel and its sub-groups</i>
<b>Plant systems sub-group</b>	
<b>DR ROGER TURNER</b> (Chairman)	British Society of Plant Breeders <i>Chief Executive of this society representing the interests of plant breeding companies</i>
<b>DR JOHN BRAUNHOLTZ</b>	Horticultural Development Council <i>representing the interests of growers</i>
<b>PROFESSOR IAN CRUTE</b>	Horticulture Research International, Wellesbourne <i>Director of this institute site researching science relevant to horticultural crops</i>
<b>PETER LIMB</b>	Farmer; NFU Cereals Committee
<b>PROFESSOR BEN J MIFLIN</b>	Institute of Arable Crops Research, Rothamsted Experimental Station <i>Director of this institute researching all aspects of science relevant to arable crops</i>
<b>J FRANK OLDFIELD</b>	Farmer; Home Grown Cereals Authority
<b>DR GREG SAGE</b>	Plant Breeding International, Cambridge, <i>researcher into plant breeding technologies</i>

<b>DR BRAM VAN DER HAVE</b>	<i>Zeneca Seeds researcher into plant breeding technologies</i>
<b>Livestock systems sub-group</b>	
<b>JUDY MACARTHUR CLARK</b> (Chairman)	<i>Veterinarian and chair of Farm Animal Welfare Council R&amp;D group</i>
<b>DR MIKE BAXTER</b>	<i>Design Research Centre, Brunet University Head of this centre and with expertise in equipment design processes</i>
<b>PROFESSOR PETER BIGGS</b>	<i>Past Director of the Institute of Animal Health with expertise in animal health research</i>
<b>JEREMY BURDETT</b>	<i>Dairy farmer with expertise in low input farming techniques</i>
<b>PEEL HOLROYD</b>	<i>Ex Marks and Spencer with expertise in retailing in the food sector and in food production technologies, particularly in poultry</i>
<b>FRASER HART</b>	<i>Pig and poultry farmer with expertise in intensive farming systems</i>
<b>DR ALISTAIR LAWRENCE</b>	<i>Dept of Genetics and Behavioural Science, Scottish Agricultural College researcher in animal welfare and behaviour</i>
<b>DR CHRISTINE NICHOL</b>	<i>Dept of Clinical Veterinary Science, University of Bristol researcher in animal welfare and behaviour</i>
<b>PROFESSOR DAVID ONIONS</b>	<i>Dept of Veterinary Pathology, University of Glasgow researcher in animal health</i>
<b>DR TONY SUCKLING</b>	<i>Royal Society for the Prevention of Cruelty to Animals Director of Scientific Affairs with expertise in animal welfare research and consumer issues</i>
<b>PROFESSOR ROGER WILKINS</b>	<i>North Wyke Research Station, Institute of Grassland and Environmental Research Head of Station and with expertise on livestock production systems</i>
<b>DR DAVID WISHART</b>	<i>ex Pfizer with expertise on the animal pharmaceutical industry</i>

#### **Forestry and Wood Products Sub-Group**

<b>PROFESSOR JULIAN EVANS</b> (Chairman)	<i>Forestry Commission Chief Research Officer (South), Alice Holt Research Station</i>
<b>DR JAMES BOLTON</b>	<i>Biocomposite Centre, Bangor Director of this centre which performs research on all aspects of woody materials</i>

**CHRIS CLOY**

BSW Sawmills, Carlisle *with expertise in industrial timber production*

**NEIL JARRETT**

Building Research Establishment *co-author of Timber 2005, use of timber in the construction industry*

**DR PETER SAVILL**

Oxford Forestry Institute *researcher on silviculture*

**DR JOAN WEBBER**

Forestry Commission Research Division *researcher on pests and diseases affecting trees and on the use of forest products*

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# ANNEX TWO

## PLANT SYSTEMS SUB-GROUP (Roger Turner, Chairman)

### Background to the sector

1. Primary UK production (at 1995 prices) of the major arable and horticultural crops is given below:

<b>ARABLE</b>	<b>£ MILLION</b>	<b>HORTICULTURE</b>	<b>£ MILLION</b>
Cereals	2908	Vegetables	1186
Potatoes	1004	Fruit	247
Sugar beet	323	Hardy ornamentals	289
Oilseed rape	362	Flowers & protected crops	347
Pulses	138		
<b>Total</b>	<b>4712</b>	<b>Total</b>	<b>2086</b>

2. In addition to this primary production there are several major industries providing products that are vital to a successful agricultural economy. For example, the UK agrochemical market was valued in 1995 at £450 million end-user sales with a further £870 million export sales [2](#); the UK fertilizer sales to the arable sector are valued at £324 million [3](#); and the UK arable seeds business has an annual turnover of around £130 million [4](#).
  3. In support of these vital sectors of national wealth, in 1992/3 the UK public sector spent £31.4 million on Research and Development (R&D) related to arable crops, £15.4 million on horticulture and £27.6 million on basic plant science, a total Of £74.4 million [5](#).
  4. Our sub-group, (whose membership is given in [Annex 1](#)) has concentrated initially on cereals and horticulture in this large and diverse market sector. Three themes form a backdrop to our discussions. First, we recognise that UK agriculture operates in an international arena and spending decisions made by international agro-businesses are made on the basis of international markets. Second, the UK agriculture sector has been particularly successful in the past in taking up new technology and incorporating them quickly on farm. Third, the land resource available to agriculture and horticulture is finite - Jerome K lerome remarked that "One should always buy land since they are not making any anymore".
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- 2 British Agrochemical Association annual report 1995
  - 3 Fertilizer Manufacturer's Association Fertilizer Review 1996
  - 4 Agricultural Supply Industry published information
  - 5 Priorities Board for Research and Development in Agriculture and Food, report published November 1993.
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## Key drivers

5. Political influences are and will remain key drivers. Political agreements within the European Union (EU) are likely to dominate in the short term with global political agreements (eg the General Agreement on Tariffs and Trade - GATT; and its successor the World Trade Organization - WTO) becoming of increasing importance in the longer term. The expansion of the EU and increasing production in East European countries will bring a huge potential production capacity into the same market framework as the UK and this is likely to lead to further reform in the Common Agricultural Policy (CAP) and removal of support for cereals and other crops. Demand for cereals, especially in East Asia, is likely to increase enormously.
6. Legislation, especially that concerning environmental protection, will continue to be crucial to the success of agriculture, for example on nitrate and pesticide levels in drinking water, the release of genetically modified organisms and the extraction of water for irrigation. In the longer term the effects of the UN Biodiversity Conventions to give more control to national governments over the rights to exploit genetic material will have a major impact on the (largely Western) plant breeding industry.
7. Public perception of new developments in agriculture will be vital to the sector's continued success. In particular, the first generation of products of biotechnology will be subjected to intense scrutiny. The sub-group feels that such products will be accepted by the public over the timescale considered here.
8. The financial reward to be gained from intellectual property in plant biotechnology will be a key factor for companies in deciding whether to maintain their investment in these new technologies. EU decisions on the legislation controlling ownership of intellectual property, in particular patents on genetically modified parts of the plant genome, and national interpretations of this legislation, will be critical.
9. Climate change (causing increasing demands on water supplies and including rising temperatures, UV-B levels and ozone concentrations as well as other effects) is likely to have a significant impact on the sector including as yet only partially characterised effects on the growth of crop plants and the spread of pests and diseases.
10. Technology can itself be a driver, as well as providing opportunities to respond to other drivers, as it can create new markets or produce radical changes in existing ones. Key technology drivers for the sector include information technology, for example the ability of decision systems linked to precision farming greatly to improve efficiency, and biotechnology, for example the ability to produce transgenic crops.

## Scenarios

11. The sub-group has developed the following scenarios or imagined sequences of future events as an aid to focusing on those factors that will be common for a variety of possible futures. The scenarios are deliberately somewhat extreme but have been useful to us in helping broaden our horizons from that which is "most likely" based on past history.

## SCENARIO 1

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### Surpluses

A combination of biotechnology, breeding, improved husbandry and bringing remaining spare land into production (particularly in Eastern Europe) will allow the rate of increase of worldwide cereal production seen over the last 40 years to continue. Improved distribution and reduced post-harvest waste will dramatically affect the amount of food available for eating. World population increase will slow down or even stabilise, because of factors such as diseases, famine and the improved education (particularly health education) and status of women in developing countries. Living standards in the non-Western world will remain static or fall. GATT/WTO rules on price support will remain or toughen. The increasing liberalisation of trade will be satisfied by prosperous and technologically advanced horticultural and agricultural industries. Increasing affluence will stimulate the purchase of fresh produce, flowers and ornamental plants from progressive growers.

## SCENARIO 2

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### Environment

In a situation of local surpluses and high Gross National Product, environmental issues will be paramount. For example, concerns about residue levels in food of mycotoxins, pesticides, nitrates and the safety of genetically modified organisms will force more stringent controls. Land- and water-use policies and cross-compliance (compliance to regulations set by different agencies) to meet increasingly complex and restrictive legislation will impose more burdens on farming practice. The political strength of environmental lobby groups will increase. On the plus side, climate changes will give indirect benefits to UK agriculture. An example is the increased opportunities for cereal exports when severe drought affects production in Southern Europe.

## SCENARIO 3

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### Free market growth and grain shortages

Current high demand for cereals has led to a marked increase in prices and a decrease in stocks - this has already caused the EU and the US to bring more land back into production. In turn, this will restore supplies and replenish stocks leading to a lowering of prices and a removal of land from production. This cycle is expected to recur over the next 10 years. After this, the increased demand from China and South East Asia and other countries that become more industrialised, and the predicted rise in world population, is expected to exceed the capacity of existing available land. As this happens, we will pass into the second phase of this scenario - grain shortages.

World population will continue to increase at current levels. The speed of increase in grain yield will slow down. The South East Asian population will change diet to consume more meat and hence require more grain to feed those livestock. This will lead to a drop in grain stocks and generalised shortages.

12. The real future is likely to lie somewhere between these scenarios and oscillations in production, sometimes of short duration, can be expected. The environmental scenario can be seen as part of scenario 1 but if there is a balance between scenarios 1 and 3, then environmental issues will be pivotal. Hence it is included here as a separate scenario.

### **Future plans**

13. We now aim to sound out farmers, growers and academics about these scenarios at a variety of events around the country. We will then develop our recommendations for SET priorities and other issues that we feel are important to the long-term health of the sector.

RG Turner

**Dr Roger Turner**

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# ANNEX THREE

## LIVESTOCK SYSTEMS SUB-GROUP (Judy MacArthur Clark, Chairman)

### Background to the sector

1. Estimates of the primary output of the sector in 1995 are as follows:

	<b>MILLION ANIMALS</b>	<b>£ BILLION (1995 PRICES)</b>
Cattle (and dairy)	11.7	6.1
Pigs	7.5	1.1
Sheep (and wool)	43.0	1.3
Poultry (and eggs)	125.0	1.5
<b>Total</b>	<b>187.2</b>	<b>10.0</b>

2. In addition, an estimated Of £327 million of veterinary pharmaceutical products was sold in this country in 1995 including pharmaceuticals, biological control agents and medicinal feed additives [2](#). in 1992/93, the public sector R&D expenditure on all aspects of livestock research, including basic animal science, was £94.8 million [3](#).

### Sub-group activities

3. My sub-group (whose membership is given in Annex i) has initially focused its attention on animal health and welfare issues since we felt that these topics had been given little in-depth consideration by the ANRE panel during the first foresight exercise. Latterly, however, the sub-group has expanded its focus, and membership, to consider livestock systems as a whole.

4. As a first step, we attempted to define the key drivers which influenced attitudes to livestock farming and its future in the U K. Among these were the recognition that we can only afford to have concerns over diet and health and concerns for animal welfare and for the environment as long as affluence continues. Furthermore, changes introduced by the GATT/WTO, the adaptation of the CAP and the expansion of the EU are all likely to increase competition and require new and better marketing strategies for sector products. Finally, competition for funds for R&D sometimes discourages interdisciplinary collaboration between academic groups and the European regulatory framework tends to drive animal health pharmaceutical R&D overseas, especially to North America.
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2 Figures provided by the National Office of Animal Health (NOAH)

3 Priorities Board for Research and Development in Agriculture and Food, report published November 1993.

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5. Against this background, we developed three scenarios for a likely future for livestock agriculture in the UK. These scenarios are deliberately somewhat extreme, and the reality is likely to contain a balanced mix of all three. However, we believe that by exploring the extremes of possibilities we will be in a better position to see how the future might develop. The sub-group will go on to define those market and research opportunities which are robust enough to be important under all the scenarios, and to identify the barriers to progress and any skills shortages.

## SCENARIO 1

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### "Intensive"

A high volume system in which the value of each commodity is low and production is under constant pressure to reduce costs, particularly from overseas. Nevertheless, the need for quality will be paramount and opportunities exist to improve the sector's competitiveness with:

- improved disease control and diagnosis;
- genetic control to select for suitability in this system;
- improved storage to deliver perishable products worldwide;
- increased automation for all processes involved in the production chain;
- better identification and audit processes to increase accountability all the way from conception to consumption.

Whilst employment will decrease per capita of production on the farm, we envisage opportunities for the creation of many jobs in the downstream processing industries. It is difficult to see how issues relating to welfare will figure more than superficially in this scenario.

## SCENARIO 2

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## "Niche"

A low volume system in which added value is critical and in which the U K maybe particularly well placed to establish a lead. It will be important to differentiate the product from the low cost equivalent produced in intensive systems. The advantages which justify a higher price must be both real and obvious in terms of a high welfare production system and a healthy (and tasty) diet for the consumer. Hence opportunities exist not only to improve our understanding of welfare and food quality, but also for improved genetic selection according to health and welfare criteria, for better monitoring and quality assurance systems and for increased point-of-sale information using innovative IT methodologies.

## SCENARIO 3

## "Import"

The third scenario envisages an increased dependence on imports, whether of the intensive or niche type of product. This arises as a consequence of

- the full implementation of the GATT and WTO regulations;
- the predicted enlargement of the European Union to include at least some Eastern European countries and the impact this will have on the CAP;
- the increased international movement of live animals and extended shelf-life of perishable products;
- the continued pressure on resources for R&D which might give the UK a competitive edge in this international marketplace.

6. The First two scenarios may be considered to be diametrically opposed although we recognise that the niche market may play a "pathfinder" role in developing innovative techniques which can be transferred beneficially to the intensive market. Nevertheless, both these scenarios imply a constant pressure on industry to be cost-effective if it is to withstand the threat from imports. Thus, alongside safety, quality, welfare and environmental issues, issues of profitability are critically important in identifying research and market opportunities.
7. One of the major barriers to progress identified by the sub-group so far relates to communication links, particularly between scientists and the livestock industry. Although there are good links in some areas, the coverage is patchy. Such communication is hindered by the character and broad range of "interested parties" in this sector. The range spans farmers in all the different livestock species sub-sectors, small engineering and building companies, livestock transporters, pharmaceuticals and vaccine manufacturers, food processors and retailers, veterinary practitioners and animal feedstuffs manufacturers, which comprise a few large but mostly small companies, single-handed units and isolated individuals. In addition, there are also agricultural economists as well as welfare and environmental lobby groups. Communication problems are also apparent between scientists and regulators, resulting sometimes in regulations and laws, particularly in the European dimension, which are not supported by scientific understanding, and between different scientific disciplines where competition for resources sometimes engenders a spirit of distrust rather than cooperation.

## Plans for the future

8. The sub-group sees the issue of communication as one of the most critical to future progress. We are also aware of the importance of full consultation to enable all the interested parties to contribute to discussion on the long-term future of the UK livestock industry. We have therefore adopted a dual strategy for the future which we hope will address both these issues. The first element was a one-day workshop held in July 1996 at which representatives of a wide range of interested parties attended. A pre-workshop consultation exercise involving interviews with key players and a postal questionnaire provided the starting point for this event which was structured to encourage a consensus view to emerge on desirable policy actions related to initiatives for particular topics of R&D or on the infrastructure for research. A report from the workshop will be published separately and is available on request from the sub-group secretary. This report will be a key resource for the second element, a round of dissemination events to be held in late 1996/early 1997.
9. Success in any foresight exercise is difficult to assess in the short or even medium term. Nevertheless, we envisage a successful outcome of this process being seen through: a more widespread vision of ways in which the UK livestock industry can be increasingly profitable as well as being acceptable to the public; greater communication between the industry and scientists so that research is more relevant to the needs of the industry; and effective and rapid transfer of new technologies into practical application in the industry.



**Judy MacArthur Clark MRCVS**

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# ANNEX FOUR

## FORESTRY & WOOD PRODUCTS SUB-GROUP (Julian Evans, Chairman)

### Background to the Sector

1. The forests of Great Britain occupy about 2.45 million hectares or 10% of the total land area. This proportion is amongst the lowest in Europe (only Ireland and Holland have smaller percentages) and consequently the forest products industry based on UK sourced material is also small. In 1994, UK production of wood and wood products was 7.6 million m<sup>3</sup> of which 3.5 million m<sup>3</sup> was softwood sawlogs (mainly for the construction industry), 0.3 million m<sup>3</sup> hardwood and 3.1 million m<sup>3</sup> particle board, fibre board and paper board. About 85% of our demand is met by imports mainly from Scandinavia, Eastern Europe and North America. In 1994 this was 48.2 million of which 18.3 million m<sup>3</sup> was solid wood, 16.5 million m<sup>3</sup> paper, 8.7 million m<sup>3</sup> pulp and 4.7 million m<sup>3</sup> panels <sup>1</sup>. This heavy dependence on imports - it is the third most significant sector after energy and food - results in timber prices being largely determined by the world market.
2. Forestry has seen substantial change during the present century with the area of land under forest more than doubling from a tow of about 4.9% in 1900. A programme of substantial forest expansion in the 1950s and 1960s has created a large high quality conifer resource now coming to maturity and attracting considerable inward investment in recent years. During this period there has been some further erosion of many valuable semi-natural woodlands, which suffered much devastation during the two World Wars. However, this trend came to an abrupt halt in 1970 and since the early 1980s there has been a steady expansion of broadleaved planting and some rehabilitation of former ancient semi-natural woodlands such that today the amount of conifer planting and broadleaved planting is about the same. In the future the area of forest is expected to continue to expand at a small but steady rate (20,000 hectares per year) and some new woody fibre based crops, such as those grown for burning to produce energy, may develop.
3. One other change has been apparent. Britain's forests have evolved from a resource primarily producing much needed timber to diverse trees and woodlands meeting many different purposes embracing amenity, landscape value and biodiversity as well as sustainable wood production.

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<sup>1</sup> Forestry Commission "Facts and Figures 1994-1995".

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4. The Forestry Research Coordination Committee (FRCC) each year collates a list of all research projects concerned with forestry and wood products. In 1995, total expenditure was just under £20 million; depending on the method of measurement this represents approximately 2% of the forestry industry sector's annual turnover.

## Sub-Group Activities

5. Given the focused nature of this sector, my sub-group (members are listed in [Annex 1](#)) has been able to progress quite quickly and we have produced a set of priority recommendations based on our discussions and feedback from the industry and from academic researchers. We first identified key issues and agreed a base scenario and then commissioned a report reviewing all the available statements of research priorities as identified by existing customers in both the public and private sector. Forty organisations across the forestry industry from Government through private sector and commerce to non-government organisations were surveyed and this useful collection of background material provided the basis for prioritizing research across the forestry and wood products sector. We then grouped these priority topics using a classification developed by the FRCC. For each group, we identified a small number of key issues and tried to encapsulate these with a vision statement.
6. The sub-group's preliminary findings were disseminated across the forestry sector including presentations to the FRCC, the Institute of Chartered Foresters, the Timber Growers Association, members of the Forestry Commission Advisory Committee on Forestry Research and Research Division Heads of Branches, various academic groupings and in the trade press [2](#).

## BASE SCENARIO

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### Three broad expectations were agreed

- Increase the proportion of forest products sourced within Britain;
  - Britain's forests and forestry industry should grow and manufacture for quality of product;
  - forests and woodlands must increasingly deliver multiple sustainable benefits.
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2 Forestry and British Timber, June 1996

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### Priority Needs

## **GENETICS AND TREE PHYSIOLOGY**

- We need to select, breed and genetically transform trees to meet specified end uses.
- Improved knowledge of tree and stand physiology will aid modelling woodland processes and inform management responses to environmental change.
- Better understanding of lignin chemistry and secondary extractives will significantly develop our ability to modify trees for improved end use characteristics.

### Vision

For production forests, to use modern biotechnology to cultivate designer trees quickly and sustainably.

## **SILVICULTURE**

- More reliable technologies are needed to allow greater dependence on natural regeneration, alternatives to clear felling silviculture, and use of mixed species.

### Vision

To enjoy forests and woodlands for landscape, for biodiversity and for commercial gain.

## **PROTECTION**

- To maintain vigilance to minimise risks from exotic pests and diseases.
- To equip forest managers and researchers with the tools (such as diagnostic techniques and the knowledge of pest life cycles) to respond rapidly to the potential for change in endemic pests, from selection pressures or arising through global environmental change.
- New humane methods of controlling grey squirrels to minimise what is the biggest single threat to broadleaved plantations.

### Vision

New pests, diseases and damaging agencies will continue to appear - we must be ready for them.

## **WOOD PRODUCTS**

- Devise rapid assessment techniques of timber and stand quality using non-destructive testing.
- Twin-track strategy of future planting and managing firmly directed towards timber quality, and maximise the use now of large reserves of lower quality wood.
- Better and environmentally friendly techniques for separation, fractionation and recombination of woody fibres for a range of biocomposites which will give tremendous scope for the improved utilisation of woody plants.
- The greatest contribution engineering can make to improve quality of forest products is to develop cost-effective, mechanised pruning.

### Vision

Much more can be made of woody plant materials in quality, diversity and application.

## **ENVIRONMENT**

- Global environmental change will increasingly stress trees and risk a greater disease and pest burden.
- Forests and woodlands are a reservoir of biodiversity not yet fully developed owing to inadequate understanding and knowledge about natural processes.

### Vision

Safeguard Britain's trees and forests through understanding the dynamics of global environment change, genetic diversity and ecological processes.

## **ECONOMICS AND SOCIAL ISSUES**

- Evaluate whole economy impact of investment in forest creation, including refinement of valuation of non-market benefits.
- People's perception of quality of life is much influenced by the presence and well-being of trees and woodlands in their immediate environment; management of such tree resources is crucial.
- Greater knowledge of rooting and below-ground biology will aid above-ground care for maintaining healthy amenity trees in the built environment.

### Vision

One dining-room table equals three hours orienteering in upland forests equals one litre of petrol...

## **Skills in forestry research**

7. The sub-group is concerned about the diminishing skills base in forestry research. In some areas, key staff with invaluable expertise are close to retirement age and there are few opportunities for research training of new entrants in order that this expertise might be passed on. We feel that this might reduce the level of expertise in some subjects such as forest products, entomology and pathology below a critical mass. This could seriously undermine the UK's capability to compete in new markets in the future and to protect the wellbeing of our forest estate. We will be asking research employers to consider ways to alleviate this situation.

## **Future plans**

8. The sub-group feels that it has a broad consensus across industry and academia on the priorities for future R&D and will now work with the FRCC to influence research sponsor's programmes, in particular to encourage collaborative research with industry. This further work, will be reported in the Panel's second report. We welcome and invite comments on our ideas - please direct these to our Secretary, Dr David Rawlins (details in the [main report](#)).

A handwritten signature in black ink that reads "Julian Evans". The signature is written in a cursive style with a long horizontal stroke at the end.

**Professor Julian Evans**

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## ANNEX FIVE

### PRIORITY RECOMMENDATIONS OF THE ANRE PANEL<sup>1</sup> RELEVANT TO THE AHF SECTORS

#### Investment is required in the following areas:

-  **Animal, microbial and plant biotechnology and cognate sciences** underpinning new products and processes in agriculture, horticulture, and forestry, aquaculture, pharmaceuticals, land and water remediation, waste management, and fossil-fuel processing, and other industries (e.g. molecular basis of plant and animal breeding, pest and disease detection and control, vaccines, metabolic engineering to provide new uses for terrestrial, freshwater and marine crops and animals). This work is crucial for our understanding of how organisms function and develop, central to integrative bioscience, and exploits the various genome initiatives in plants and animals.
-  **Robotics; remote sensor and survey systems;** predictive modelling in the presence of uncertainty; artificial intelligence and expert systems. These aspects are essential for agriculture and horticulture;
-  **Diet and health:** more healthy, attractive and better tasting food products from plants and animals, with improved safety and nutritional value, freshness, convenience, appearance and value.
-  Improved technology for utilising **forest products**, improving **wood quality**, and finding sustainable **substitutes for traditional hardwoods and wood pulps**.
-  **Fin-fish, shell-fish and algae:** studies on **wild populations** and their harvesting, management and utilisation; **aquaculture**, particularly with regard to biotechnology, breeding, diversification, habitats, containment structures, and environmental impacts.
-  **Integrated ecosystem management**, including maintenance, restoration, and utilisation in the context of terrestrial systems. Realisation and understanding of the full value of **biodiversity and natural and managed ecosystems** including sustainable, terrestrial and aquatic farming systems.
-  **Alternative energy sources** including fuel-producing crops particularly forest products.

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<sup>1</sup> Technology Foresight Progress through Partnership Vol II Agriculture, Natural Resources and Environment, 1995, HMSO

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Structural changes in agriculture, horticulture and forestry will demand greater vertical and horizontal co-ordination, from fundamental research to the primary producer, processor, retailer and consumer, thereby facilitating the speedy uptake of new ideas and technology (e.g. welfare-friendly systems for livestock; utilisation of animal wastes; fishmeal substitutes; new multi-option, pest- and disease-resistant crops; crops as bioreactors; precision agriculture; greater species and cultivar diversity throughout the year; on-farm added value systems; new bioremediation systems).



Public and political understanding of science and technology, and of the balance between risk and benefit in applying new technologies, and experts' appreciation of the importance of taking proper account of the public's perspective of their work. There is also a need for Legislation, training and advice to be soundly based. These aspects are critical to the biotechnology and environmental programmes.

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# ABBREVIATIONS AND ACRONYMS USED IN THE REPORT

AHF	Agriculture, Horticulture & Forestry Panel
ANRE	Agriculture, Natural Resources & Environment panel,
BBSRC	Biotechnology and Biological Sciences Research Council
CAP	Common Agricultural Policy
DANI	Department of Agriculture, Northern Ireland
DoE	Department of the Environment
DTI	Department of Trade and Industry
EU	European Union
FRCC	Forestry Research Coordination Committee
GATT	General Agreement on Tariffs and Trade
LINK	Government scheme for collaborative research with industry
MAFF	Ministry of Agriculture, Fisheries and Food
NERC	Natural Environment Research Council
NFU	National Farmers Union
OST	Office of Science and Technology
R&D	research and development
SET	science, engineering and technology
SOAEFD	The Scottish Office Agriculture, Environment and Fisheries Department
UN	United Nations
UV-B	Ultraviolet B light
WTO	World Trade Organization

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