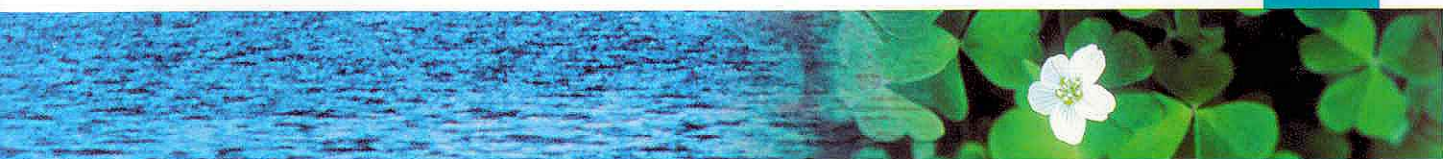


Centre for Ecology & Hydrology

Annual Report 1997-1998



**Centre for
Ecology &
Hydrology**

Natural Environment Research Council

Foreword



Prof. John Krebs FRS
Chief Executive
Natural Environment
Research Council

The environmental agenda is generating a rapidly evolving and increasing demand for scientific knowledge, understanding and the capacity to predict our future environment resulting from natural or man-made change. Against this background the NERC has prepared and published its first integrated science strategy "Looking Forward". The three main priorities identified in "Looking Forward" are firstly to increase investment in basic science, secondly to focus on key objectives within five broad areas (biodiversity, environmental risks and hazards, global change, natural resources, and pollution and waste) and thirdly to foster interdisciplinary science.

The universities, and in particular the NERC's own Centre/Surveys, have a key role to play in achieving these goals. It is therefore important to recognise that the Prior Options Review in 1996, which for a time generated some uncertainty within the NERC Centre/Surveys, has now led to very positive benefits. In September last year I was delighted that Council approved a major package of "Rationalisation and Restructuring" for the Centre/Surveys within the Prior Options Review. As part of this a start has now been made within CEH to improve its facilities through the construction of a new laboratory extension at the Wallingford site and to enhance the Centre's skill base. Further development of the Centre's facilities are anticipated over the next two to three years.

These investments by Council in the Centre/Surveys is recognition of the high quality of their science and the distinctive role they have in providing a national capability and meeting science needs.

During the past three years there has also been much emphasis on establishing a more transparent relationship between Council and the Centre/Surveys and in providing a greater degree of independence for them. However, at the same time, I have been careful to preserve our corporate identity and to give every encouragement to Centre/Survey Directors to strengthen their integrated science activities both within and between their organisations.

These new relationships between Council and its Centre/Surveys are now almost fully developed. As part of these new arrangements I have supported the establishment of Advisory Committees for Centre/Surveys and I am very pleased that the CEH Advisory Committee is now formed under the distinguished Chairmanship of the Earl of Cranbrook.

I have already mentioned the uncertainty that was felt throughout the NERC during the early part of this year in relation to Prior Options. Despite this the CEH scientists have continued to contribute fully to national and international science. They have, for example, raised their output of peer-reviewed publications by some 21% in relation to last year. An excellent achievement which augurs well for the future.

My frequent visits to CEH sites are always enjoyable and stimulating occasions. The enthusiasm of staff and the high quality of their science is impressive and uplifting.

This, the 1997-98 Annual Report of CEH, presents a selection of the scientific achievements for the year together with information on administration and funding. It introduces the four Scientific Reports of CEH's component Institutes. I commend this and its companion reports to you.

JOHN KREBS

Cover Photographs

Winter on Lake
Windermere - site of
CEH's IFE headquarters.

The Eyed Hawk Moth,
Smerinthus ocellata

Bluetongue virus VP
Trimer as resolved by
X-ray diffraction

ITE BUSH
20 NOV 1998
LIBRARY

Annual Report

1997 - 1998

Centre for Ecology & Hydrology

Natural Environment Research Council

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environmentally-friendly paper*

ISBN: 1855311984

Location of CEH sites

Centre for Ecology & Hydrology Directorate

1. Wallingford

Institute of Freshwater Ecology

2. Windermere
3. Wareham
4. Edinburgh

Institute of Hydrology

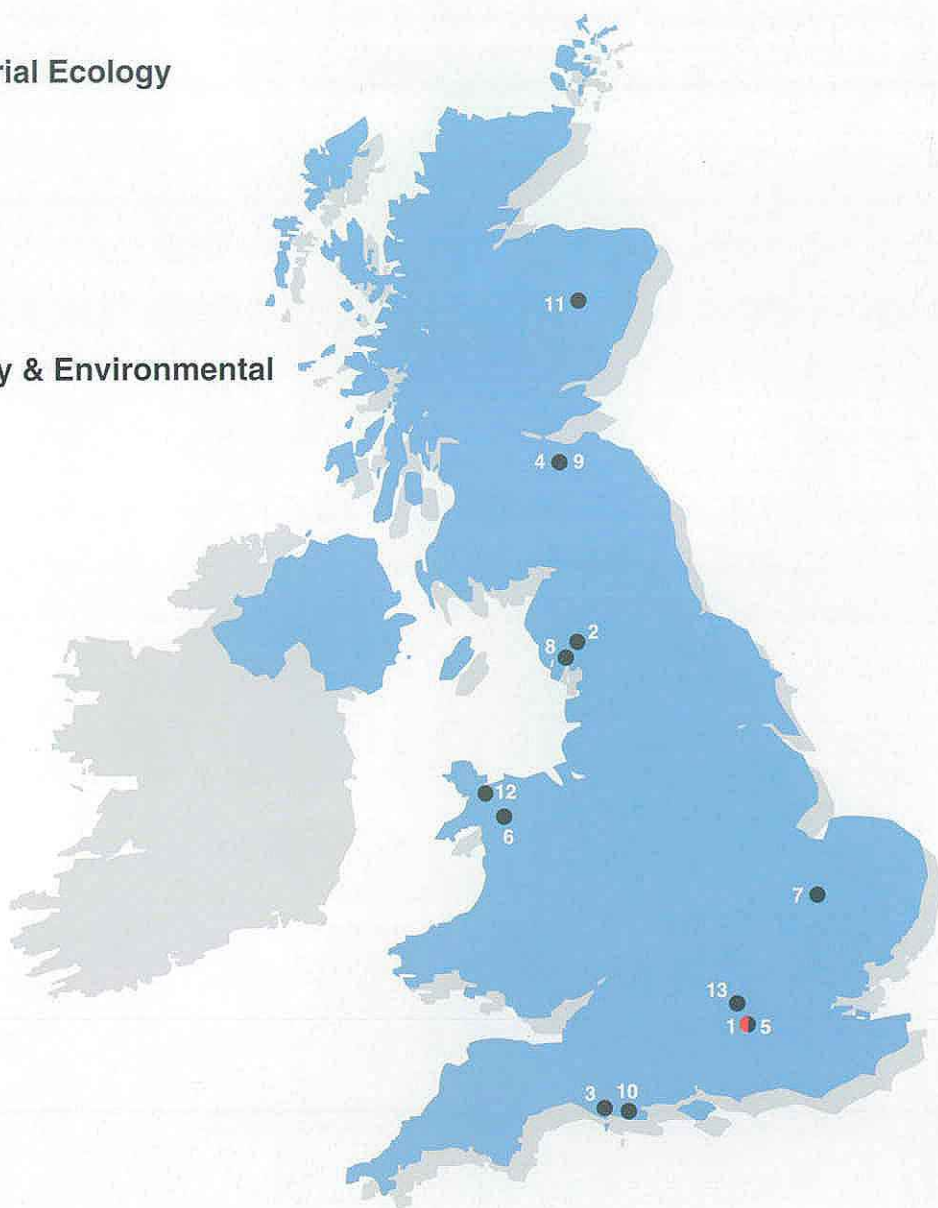
5. Wallingford
6. Plynlimon

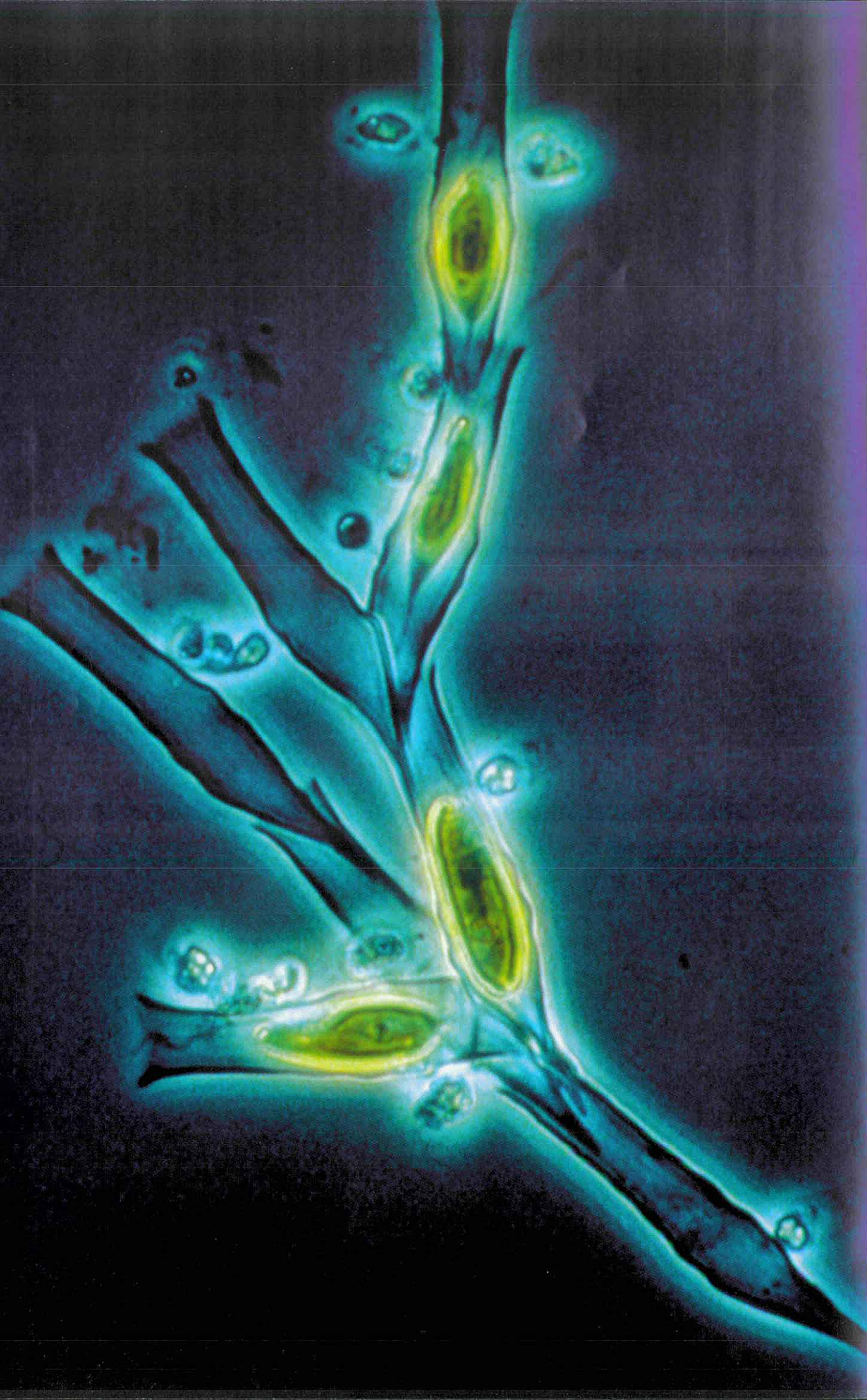
Institute of Terrestrial Ecology

7. Monks Wood
8. Merlewood
9. Edinburgh
10. Furzebrook
11. Banchory
12. Bangor

Institute of Virology & Environmental Microbiology

13. Oxford





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The CEH Mission is delivered through:

To advance the sciences of ecology, environmental microbiology (including virology) and hydrology through high-quality and internationally recognised research leading to a better understanding and quantification of the physical, chemical and biological processes relating to land and freshwater and living organisms within these environments.

- ▶ an holistic approach to the terrestrial and freshwater sciences
- ▶ an international reputation for science of the highest quality
- ▶ a network of sites throughout the UK
- ▶ research projects across the world
- ▶ extensive publications in national and international journals
- ▶ the maintenance of a high quality skills base
- ▶ an extensive involvement in European and international science programmes and networks
- ▶ ten issue-based integrated Science Programmes
- ▶ internal and external quality assurance procedures
- ▶ the development and involvement in NERC Thematic Programmes
- ▶ joint research initiatives with HEIs
- ▶ contributions to Foresight and NERC science strategies
- ▶ development of new instrumentation, methodologies and techniques
- ▶ an extensive range of laboratory and field facilities

To investigate, through monitoring and modelling, natural changes in the ecological, microbiological and hydrological environments, to assess both past and future changes, and to predict man's impact on these environments.

- ▶ long term monitoring of key ecological and hydrological sites
- ▶ the management and analysis of long-term datasets
- ▶ the development of internal scientific networks to address specific environmental issues
- ▶ ongoing cross-Institute collaborative research projects
- ▶ contributions to national and international programmes investigating global change
- ▶ development of predictive models

The CEH Mission is delivered through:

The CEH Mission

To secure, expand and provide ecologically and hydrologically relevant data to further scientific research and provide the basis for advice on environmental conservation and sustainable development to governments and industry

- ▶ managing of two NERC Designated Data Centres
- ▶ the management of national and international environmental monitoring programmes
- ▶ wide dissemination of data in a user-friendly format
- ▶ scientific research for government departments (both national and overseas)
- ▶ contributions to government consultations on environmental policy
- ▶ advice to statutory bodies
- ▶ extensive involvement with and contribution to governmental and scientific committees (nationally and internationally)
- ▶ undertaking collaborative projects with industry

To promote the use of the Centre's research facilities and data, to provide research training of the highest quality and to enhance the United Kingdom's research base, industrial competitiveness and quality of life

- ▶ hosting visiting workers from international research organisations
- ▶ the supervision of joint studentships with UK universities
- ▶ teaching in UK universities
- ▶ producing a variety of publicity material
- ▶ holding scientific seminars and conferences
- ▶ provision of a safe and healthy working environment for staff
- ▶ addressing environmental topics of national importance
- ▶ products being made commercially available
- ▶ establishing dialogue with industry and user groups
- ▶ contributions to press, radio and television coverage of science
- ▶ designated schools liaison officers
- ▶ establishing joint venture and spin-off companies

Directors' Introduction



Prof. Brian Wilkinson
Director, Centre for
Ecology & Hydrology



Prof. Mike Roberts
Deputy Director, CEH &
Director, CEH's Institute
of Terrestrial Ecology



Prof. Jim Wallace
Director, CEH's
Institute of Hydrology

The environmental agenda has shown no diminution during the year. Issues such as water resources, deforestation, dry land degradation and climate change show no signs of abatement. Natural disasters resulting from flood, drought and forest fires have caused disruption to the lives of millions of people and many deaths worldwide. Man-made disasters resulting from pollution or other causes are all too evident. For example, we are all aware of the recent accidental release of pollutants into the last great natural area of southern Spain and the impact this may have on many rare species.

Internationally there is a growing political will to address such problems. 174 countries ratified the United Nations Framework Convention on Climate Change aiming at "the stabilisation of greenhouse gases in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". In 1997 these signatory nations agreed the Kyoto Protocol which set out the first historic steps towards achieving the above goal. Nationally, with a change in Government, we have seen environmental issues move up the agenda. The Rt. Hon. Michael Meacher, MP, Minister for the Environment, in presenting the 1998 NERC Lecture, showed both his personal and government commitment towards sustainable management. He recognised "...the great value of science is that it puts things in perspective. It takes the longer term view..." and that "The development of environmental science from a descriptive to a **predictive** science has helped to put the environment centre stage" He also pointed out that "Science also has an important role in driving **innovation**.....".

CEH's ten new Science Programmes commenced at the start of this reporting year on 1 April 1997. The research undertaken within these Programmes addresses all the major environmental issues referred to above and more. It is noteworthy, relating to Michael Meacher's comments during the 1998 NERC Lecture, that there is a strong focus on **prediction**, particularly through the use of mathematical models of ecological and hydrological systems. The Science Programmes have been approved by the NERC Terrestrial and Freshwater Science & Technology Board (TFSTB) and are kept under review by independent Programme Review Groups (PRGs). The PRGs have endorsed our research programmes and have also provided some constructive suggestions for change. This input is welcomed by the CEH scientists and it will ensure that the Programmes remain dynamic and respond to wider needs. We offer our thanks to all members of the PRGs, but in particular to the Chairmen, Professor Rick Battarbee (University College, London), Professor Chris Payne (Horticultural Research International), Dr. John Rodda (formerly Director, Hydrology and Water Resources, WMO) and Professor Howard Wheeler (Imperial College, London), for their time and dedication in undertaking these reviews. The ten Programmes and a number of recent achievements arising from these are described in greater detail within the body of the report and within the Scientific Reports of the CEH Institutes.

On the *innovation* front we reported last year on the major step that had been taken by NERC, CEH and IVEM in establishing a joint company with Vacs of Life plc, called Oxford Vacs Ltd, for the commercial exploitation of novel properties of arthropod saliva proteins identified by CEH's IVEM staff. Growing commercial interest in the potential product has led to the sale of Oxford Vacs to a new company, Evolutech Plc. NERC retains a share interest in the new company and some royalty rights. The company has also invested in a major programme of research at CEH's IVEM laboratory.

CEH and the other NERC Centre/Surveys are aware that there are many opportunities for collaboration and over the past year there have been a number of new initiatives. One has been for CEH to explore, in collaboration with other Centre/Surveys, the prospects of putting in place a joint venture company, including partners outside NERC to promote NERC and UK research skills more widely overseas. These are early days, but next year we should be in a position to report more detailed progress with this venture.

Our academic links remain as strong as ever. We are particularly pleased to welcome Prof. James Lovelock as a CEH Senior Research Fellow this year. Prof. Lovelock joins the two other CEH Fellows, Prof. John Montieith and Dr. John Thornley. We think it is excellent that such eminent scientists wish to be involved with CEH in this way and we are sure that the Centre as a whole benefits from these associations.

We reported in some detail last year on the package of rationalisation and restructuring of CEH that had been approved at the September 1997 Council. This was subject to feasibility and detailed costings being made available. The elements of these proposals were to:

- ▶ build an extension to the laboratory at Wallingford to house the 50 staff who are presently in temporary accommodation, establish CEH Directorate offices and upgrade laboratory facilities,
- ▶ co-locate the two CEH Dorset sites, Furzebrook and East Stoke, on to a new site,
- ▶ move the Merlewood site and staff to the Windermere laboratory subject to satisfactory arrangements being made with the Freshwater Biological Association, which owns the Windermere site,
- ▶ close the small sites at Plynlimon, York and Stirling but, where necessary, retain facilities to retain long-term data monitoring,
- ▶ reduce existing staff numbers by 40 over a five year period, but recruit 20 young scientists so as to bring in new scientific skills,



Prof. Alan Pickering
Director, CEH's Institute of Freshwater Ecology



Prof. Pat Nuttall
Director, CEH's Institute of Virology & Environmental Microbiology

The Council's willingness to make a major investment into the future of CEH through rationalisation and restructuring is recognition of the high value placed on our science and its relevance to major local, national and international environmental issues. This is a wonderful opportunity for CEH and we have not been slow to move the process forward. Prof. Wilkinson (Director, CEH) established a number of Working Parties to develop the detailed proposals as follows:

- ▶ Dorset sites (chaired by Prof. Mike Roberts)
- ▶ Cumbria sites (chaired by Prof. Alan Pickering)
- ▶ Wallingford and small sites (chaired by Prof. Jim Wallace).

Excellent progress has been made during the year such that

- ▶ the construction of the £2.86M Wallingford extension has commenced
- ▶ the York and Stirling labs have been closed and arrangements to run the Plynlimon operations from CEH's Bangor laboratory are well advanced
- ▶ Council are considering proposals from the Working Party to relocate the two Dorset laboratories to another local site
- ▶ the Cumbrian Working Party has completed its report for presentation to Council
- ▶ there have been twelve voluntary early retirements.



Prof. Brian Wilkinson, Director CEH, Mr. Bernie Raine, Regional Manager, Weatherald Construction and Prof. Jim Wallace, Director IH (far left) after the 'cutting of the first sod' on 14 September 1998 to mark the beginning of the new building works at the Wallingford site.

The impact of rationalisation and restructuring has resulted in an uncertain year in many respects. For example there have been some staff reductions through early retirement. However, our scientific output has been maintained overall and in some areas has increased. This is a direct result of having highly skilled, well motivated and innovative staff and, as Directors, we recognise and value the contribution made by all staff in CEH. Output may be judged using many

indicators and a number of these are presented in the body of the report. Simply using publications, it is noteworthy that peer reviewed papers have risen by some 21% during the course of the year, which is an important indicator of our scientific impact. During the coming year the Centre will be subjected to a major Science and Management Audit which will judge our overall performance and progress.

This year's annual reporting follows arrangements established last year whereby the CEH Annual Report provides an overview of our scientific progress and principal achievements, integrating activities, organisational changes, outreach and finances. The Scientific Reports of the Centre's component Institutes present more detailed reviews of science undertaken in the CEH Programmes. The CEH Annual Report and the four Scientific Reports are complementary and we commend all of the Reports to you. Of particular note is the fact that CEH's Institute of Terrestrial Ecology is celebrating its 25th anniversary this year. ITE's report has contributions from a number of former Directors of ITE and thus presents an intriguing retrospective of developments in terrestrial ecology over a quarter of a century.

Finally, the Centre has been encouraged by NERC to establish an Advisory Committee to advise Director CEH on short and long-term scientific opportunities and priorities, the maintenance of science quality, and management policy. The Advisory Committee is now being formed. We are honoured that the Earl of Cranbrook has agreed to be Chairman.

The year ahead will bring many challenges but CEH has had an excellent year and is in a strong position to respond in such a way as to ensure that its science meets the needs of an expanding user community.

Professor Brian Wilkinson

Director, Centre for Ecology & Hydrology

Professor Mike Roberts

Deputy Director, CEH and Director, CEH's Institute of Terrestrial Ecology

Professor Pat Nuttall

Director, CEH's Institute of Virology and Environmental Microbiology

Professor Alan Pickering

Director, CEH's Institute of Freshwater Ecology

Professor Jim Wallace

Director, CEH's Institute of Hydrology





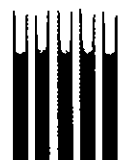
CEH Science Programme

The Science Programme of CEH provides a base that underpins national and international requirements in the terrestrial and freshwater sciences. The Programme is wide- ranging and is divided into 10 component Programmes, all of which address issues of current environmental relevance and important scientific challenges. The Programme as a whole involves extensive collaboration with academic organisations throughout the world and with international research programmes.

- 1. Soil and Soil-Vegetation Interactions**
- 2. Land Use Science**
- 3. The Urban Environment**
- 4. Freshwater Resources**
- 5. Biodiversity and Population Processes**
- 6. Pest and Disease Control and Risk Assessment for GMOs**
- 7. Pollution**
- 8. Environmental Risks and Extreme Events**
- 9. Global Change**
- 10. Integrating Generic Science**

Each CEH Programme is led by a senior scientist from within CEH - the Programme Leader. The Programmes are not static and the Programme Leaders are responsible for leading the development of their Programme and for ensuring a responsive approach as new environmental issues emerge. The scientific quality and output of the Programmes is assessed annually by independent Programme Review Groups (PRGs). The present composition of the PRGs is shown in Appendix 5.

The following section provides a description of each of the Programmes, current research and the Programme Leader's report. The detailed structure for each Programme is given in Appendix 3.



Soil and Soil Vegetation Interactions



Soils have key roles in controlling global change, pollution impacts, maintenance of biodiversity and sustainable development. An understanding of soil physical, chemical and biological processes and functions is essential to the optimal and sustainable management of soils, land and water resources and the prediction and management of the impacts of pollution, environmental change and land use.

Programme 1 will improve understanding and the ability to model key soil processes which control the transformations of materials in soils and the flux of water through the soil-vegetation-atmosphere continuum.

Programme Themes

- ▶ Physiochemical processes affecting soil-water interactions
- ▶ Biologically mediated soil processes
- ▶ Physical and physiological processes controlling soil water balances

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology
- ▶ Institute of Virology & Environmental Microbiology

Programme 1 research projects described in the 1997-98 Institute Scientific Reports

ITE

- ▶ Linking soil biodiversity and functional processes
- ▶ Development in forest soil nitrogen dynamics
- ▶ The significance of below-ground interactions to agroforestry

IH

- ▶ Controlling water use of agroforestry trees by pruning

IVEM

- ▶ Impact and degradation of 1, 2-dichlorobenzene (1,2-DCB) in soil



Programme Leader's Report

The Programme continues to focus on the three main themes of physico-chemical processes affecting soil-water interactions, biologically mediated processes and physical and physiological processes influencing soil water balances. In the first of these themes the emphasis is on the development of models of solid-solution interactions which can then be applied in, for example, work on pollution transport and global change impacts. Thus, recent work has seen the development of new models to describe interactions between organic matter, clay and oxide surfaces and soil solutions, and the production of dissolved organic matter.

One aspect of our studies on biologically mediated soil processes focuses on processes controlling production and consumption of the important greenhouse gas methane. During the last year this has produced quantification of the first annual budget of methane oxidation in a UK deciduous forest, together with an assessment of the environmental factors controlling the oxidation. Long term additions of N and S (at realistic levels) to a deciduous forest have shown reductions in methane oxidation.

A major focus in the third theme is the development of plant root systems and the transfers of water in those systems. For example, recent studies on a *Grevillea robusta*-maize agroforestry system in Kenya have shown downward fluxes of water in vertical roots in conditions where there was a strong moisture gradient from a wet surface to deeper layers. This suggests that, under certain conditions, trees may be able to siphon water to lower soil layers where it would be beyond the reach of crop roots and could be stored for later use.



The Pill millipede, *Glomeris marginata*, is important in decomposing litter in woodlands and grasslands.

Achievements

- ▶ A new model of particle surface-solution interactions (SCAMP, Surface Chemistry Model for Particles) has been encoded and applied to soils
- ▶ A unique long term (25 years) decomposition dataset of three different plant materials has been analysed and published, showing weaknesses in existing, widely applied models
- ▶ The first complete water balance for an agro-forestry system has been developed and used as the basis for model development



Prof. Mike Hornung

Land Use Science



Major changes in land use, locally, regionally and globally, have occurred over the last century. These will continue into the future and have a major impact on society. To ameliorate such impacts, the processes driving land use change need to be understood.

This Programme promotes an integrated approach to land use science that is applicable to the wide range of user community needs. The research focuses on:

- ▶ monitoring and understanding the impacts of land use change on water and carbon balances and on habitats and wildlife
- ▶ modelling the processes and effects of land use change
- ▶ developing strategies for the optimisation of land use.

These research areas will be developed to provide the basis for large-scale, long-term analytical studies of land use change.

Programme Themes

- ▶ Long term and large scale monitoring of land use
- ▶ Land use systems
- ▶ Management of ecosystems in tropical regions
- ▶ Landscape functions and modelling

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology

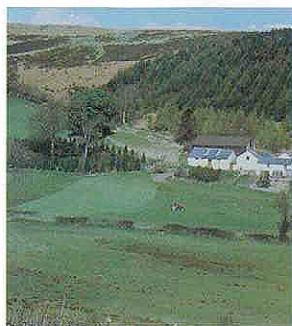
Programme 2 research projects described in the 1997-98 Institute Scientific Reports

ITE

- ▶ Land use change and biodiversity
- ▶ Large-scale dynamics of heathlands

IH

- ▶ Evaporation from mature upland coniferous forest
- ▶ Coalburn: 30 years young



Programme Leader's Report

This Science Programme deals with the monitoring and modelling of land use change, assessing the consequences on the environment, and developing responses and management systems.

The Countryside Survey 2000 (CS2000) programme, starting in 1998 and running for four years, is the fourth in a series of sample-based field surveys designed to record information on land use, landscape features, habitats and vegetation throughout Great Britain. The programme uses surveys of freshwaters, soils and land cover mapping from space and is funded principally by DETR, MAFF, EA and NERC. The field survey involves teams visiting 568 one-km squares (stratified by land type) with detailed, coded maps being made of land cover type and land use, and landscape features such as hedges, woods and ponds, and habitats. Up to 50 vegetation plots are also recorded with results becoming available in 2000. CS2000 will provide valuable information on the environmental capital of the countryside and change in this over time, and will help to guide, test and support Government policies for rural Britain.



Countryside Survey
2000 field work

Another of the Programme's strategic land use studies, the Plynlimon research catchments in mid-Wales, was marked with a special publication by the European Geophysical Society* of 30 peer-reviewed papers. Originally a study of forest water use, its research programme has become increasingly multi-disciplinary. In the 1970s 80% of the published papers were concerned solely with water quantity; in the 1990's only 20%. The increased integration of hydrology with other environmental aspects including chemistry and biology is reflected in the decision to bring together CEH's technical staff, currently at Plynlimon, with those at Bangor.

* *Hydrology and Earth System Sciences* Special Issue, Volume 1 Number 3, (1997), pp 381-764

Achievements

- ▶ Fish stocks and recruitment levels are effected by stream water quality, high flows and associated acid spates at critical times of the year
- ▶ A methodology has been developed to demonstrate the decline in quality of vegetation in the British countryside between 1978 and 1990
- ▶ Evidence has been produced which shows that the major benefits to biodiversity from organic farms are related to cropping and other land-use patterns rather than the use/non-use of chemicals
- ▶ A software system has been developed that can model bird species distribution within landscapes



Dr. Mark Robinson

The Urban Environment



Urban areas provide employment, housing and social contact but they consume resources, generate waste and pollution, alter habitats and are prone to environmental hazard and decay. The Earth Summit in 1992 highlighted the need to develop more socially and ecologically sustainable cities. In the UK, urban issues permeate the priority areas of science and technology identified in the Foresight Programme.

In response to the need for research dedicated to understanding urban environmental problems Programme 3 has two main aims:

- ▶ developing and extending, through survey, monitoring and modelling, the interdisciplinary knowledge base required to plan and achieve more sustainable urban environments
- ▶ understanding the key environmental patterns and ecological and hydrological processes in urban situations and their responses to change, especially those resulting from man's activities.

Programme Themes

- ▶ Patterns of urban land/water use and associated habitats
- ▶ Factors and processes determining the development of urban environments
- ▶ The distribution and dynamics of atmospheric pollution
- ▶ Urban water dynamics, risk and hazard
- ▶ Sustainability, restoration and remediation of urban ecosystems

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology

Programme 3 research projects described in the 1997-98 Institute Scientific Reports

IH

- ▶ Urban runoff in mixed urban/rural catchments



Programme Leader's Report

The Earth Summit of 1992 and the Kyoto Summit of 1997 both drew attention to the growing worldwide problems arising from rapid urbanisation. These include providing adequate and safe water supplies, coping with waste and pollution, and mitigating potentially damaging impacts on biodiversity. There is a need to develop more socially and ecologically sustainable cities. This theme has been taken up by the European Union in the development of the Cities of Tomorrow initiative as a major component of the Fifth Framework programme of research and development.

This Programme has been developed concurrently with NERC's major thematic programme on Urban Regeneration (URGENT). This was established to help meet the challenge of cleaning up the legacy of past contamination and to establish a sustainable development regime, avoiding past mistakes and reshaping the structure and use of the urban environment. Scientists working within CEH on urban issues have received both core scientific funding from the CEH Integrating Fund and NERC Thematic funding for collaborative research with universities, government departments and industry through successful bids to the URGENT programme. This has enabled a useful suite of projects to be established which will form the basis for a developing programme of work on the urban environment.



Experimental facility for exposing vegetation to urban street levels of vehicle emissions

Achievements

- ▶ The discovery that in Britain, unlike in central Europe, urban areas do not have significantly more plant species than the surrounding countryside
- ▶ Plant species that benefit most from urbanisation appear to do so because of increased habitat availability rather than enhanced dispersal by humans
- ▶ Involvement in seven successful full proposals to the first and second rounds of URGENT, covering such divergent issues as:
 - a scientific basis for the rehabilitation of river corridors
 - biodiversity in urban habitat patches
 - enhancement of biological process in contaminated urban soils
 - sediment dynamics in urban systems
 - urban tree planting as an aid to air pollution abatement
 - sources and sinks of urban aerosols
 - impacts of vehicle emissions on vegetation



Prof. John Good

Freshwater Resources



The need for adequate and sustainable water resources forms the basis of much environmental policy worldwide, but the conflict between demands for freshwater and resource conservation are increasing, even in climatically wet countries like the UK. The driving objective behind this Programme is the need to improve the scientific basis for the effective strategic and sustainable management of freshwater resources required to overcome these conflicts.

This Programme brings together CEH's research in water quantity, water quality and the ecological components of freshwater systems into an integrated research programme, with major themes including:

- ▶ water quantity – improving understanding in surface-groundwater interactions and water resource modelling
- ▶ water quality – measuring and modelling responses of aquatic biota to physical and chemical properties and improving water quality management
- ▶ fisheries and aquaculture.

Programme Themes

- ▶ Surface-groundwater interactions
- ▶ Regional modelling of resource availability
- ▶ Water resource modelling
- ▶ Integrated water quality modelling
- ▶ Integrating biotic response modelling
- ▶ Fish dynamics

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology

Programme 4 research projects described in the 1997-98 Institute Scientific Reports

IFE

- ▶ Earlier growth of a planktonic diatom over 50 years: perturbation, pattern and process
- ▶ Advances in modelling phytoplankton dynamics using PROTECH-C
- ▶ Population regulation in resident trout
- ▶ River fish habitat - Ignorance is bliss!
- ▶ Management of grayling
- ▶ Automatic counting of salmon smolts
- ▶ Treatment of fungal infections of farmed fish

IH

- ▶ Water resources for hydropower production
- ▶ Maintaining hydropower production at Tarbela Reservoir, Pakistan
- ▶ Simple, robust integrated hydrochemical catchment models for use in water planning

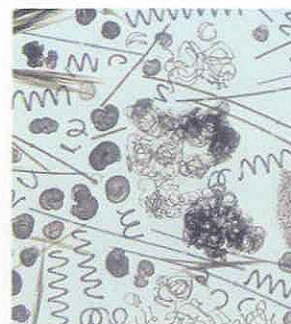


Programme Leader's Report

Looking Forward, The NERC Strategy for Science, published in May 1998, recognised the importance of water as a natural resource: 'Water is a key global issue: increased demand, combined with unusual rainfall patterns, has heightened public awareness in the UK of the importance of sustainable management of water resources'. It also highlighted the importance of 'the dynamics of individual species and populations to underpin sustainable exploitation' and recommended 'integrated studies of the full hydrological cycle of lowland rivers and wetlands'.

These statements encapsulate much of the work and ethos of this Programme. The work of CEH is underpinned by two important approaches. First, models are widely used to integrate information and test ideas on processes, quantities and fluxes: moving the science from 'descriptive to prescriptive'. These models frequently have very practical applications, such as predicting suitable sites for locating hydro-electric power stations or predicting growth of phytoplankton, which can have a large effect on water quality in lakes and reservoirs. Secondly, CEH has many large data sets that are used to validate the models and provide insights into how freshwater systems function and respond to natural and man-made impacts such as nutrient enrichment or climate change.

The wide range of staff expertise in the area of Freshwater Resources gives CEH a unique capability to understand the full hydrological cycle and the biotic and abiotic factors that control the quantity and quality of water for human use, habitat conservation and fisheries.



Typical components of a blue-green algal bloom.

Achievements

- ▶ The first steps have been taken to establish an interdisciplinary permeable lowland research facility to study chalk aquifers and their drainage systems
- ▶ The practical application of the PROTECH algal growth model has been further enhanced by incorporating the effects of deep, multiple draw-off points from pump-storage reservoirs and the movement of sediment in large shallow basins
- ▶ Studies in Lake Tanganyika (Africa) and Loch Leven (Scotland) to test the generality of ideas derived primarily from temperate systems suggest that the phytoplankton is more diverse in the tropical lake overall, but that diversity in June in both systems is comparable
- ▶ An individual-based model of sea-trout fry emergence has been developed using field observations from 1967 to 1996 and laboratory measurements of temperature effects on egg and juvenile development



Dr. Stephen Maberly

Biodiversity and Population Processes



Through the Convention of Biological Diversity and a diverse range of European and global protocols and legislation, the UK Government is committed to the conservation and sustainable use of biodiversity. Biodiversity is essential for the functioning of ecosystems, including wild places, rivers, lakes, forests, farmed land and urban environments. Understanding biodiversity is required to build sound national and international policies for the conservation of ecosystems and the sustainable use of natural resources from local to global scales. This Programme will improve understanding of microbiological and biological resources at a range of scales. The research recognises biodiversity as the earth's biological capital, considers the underlying processes and resulting functions, and directs knowledge to the sustainable management of biodiversity.

Programme Themes

- ▶ Biodiversity characterisation, pattern and monitoring
- ▶ Ecosystem function and biodiversity
- ▶ Population processes underlying biodiversity
- ▶ Conservation and restoration of biodiversity

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology
- ▶ Institute of Virology & Environmental Microbiology

Programme 5 research projects described in the 1997-98 Institute

Scientific Reports

IFE

- ▶ Testing the global ubiquity of microbial species.
- ▶ Nitrification in lakewater.
- ▶ Fluorescence microscopy and the enumeration of aquatic free-viruses.
- ▶ A comparison of phytoplankton biodiversity in two incomparable lakes (Leven, Scotland and Tanganyika, East Africa).
- ▶ Species introductions and the conservation of Vendace in Bassenthwaite Lake and Derwentwater.
- ▶ Reintroduction of Vendace to Scotland.
- ▶ RIVPACS International Workshop

ITE

- ▶ Long-term studies of avian population dynamics

IVEM

- ▶ Orbiviruses
- ▶ Entry of Bluetongue Virus
- ▶ Molecular Microbial Ecology Group, 1998
- ▶ Role of microbial biodiversity in regulating function in a freshwater ecosystem, Priest Pot, Cumbria
- ▶ Bacteria - identification and differentiation
- ▶ Antibiotic resistance
- ▶ Viruses



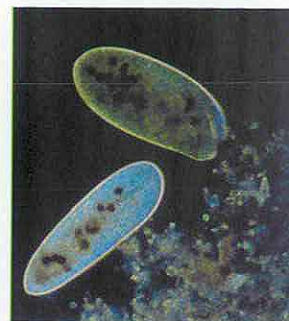
Programme Leader's Report

Biodiversity characterisation, pattern and monitoring. It is unclear whether the geographically restricted distribution seen in large animals also applies to free-living micro-organisms. Scientists at IFE have found that all 85 species of ciliated protozoa living in the crater-lake of an extinct volcano in Australia are already known from Northern Europe. Ciliates are among the largest and most fragile of microbes. Therefore, if ciliate species are ubiquitous, it is likely that the same is true for the many smaller, more abundant and more easily dispersed microbial species, including bacteria.

Ecosystem function and biodiversity. In the sea viruses are reported to comprise 10% of the suspended phosphorous and, by implication, have a role in the 'microbial food web'. IVEI is studying bacteria which are responsible for the virus-like particles seen in water samples from Priest Pot, a one hectare pond in Cumbria, in an effort to understand their possible role in the ecosystem.

Population processes underlying biodiversity. Scientists at ITE have developed and tested a model which predicts the impact of environmental changes on the winter mortality rate of an estuarine shorebird. It is now possible to predict, for example, whether a particular level of disturbance from people, loss of inter-tidal feeding area and shell-fishing will affect the mortality rate and thus population size. Work is in progress to parameterise the model for a range of bird species so that conservationists can base their decisions on a much firmer scientific footing.

Conservation and restoration of biodiversity. Field trials and greenhouse experiments have confirmed that the fen violet, *Viola persicifolia*, requires a low summer water table. In contrast, observations in water meadows managed for water birds confirm that raised water tables are essential for both improved wader breeding performance and enhanced wader and wildfowl numbers.



Ciliated protozoa:
Frontonia vernalis
(green), *F. leucas* (blue)

Achievements

- ▶ Populations of mature mahogany (*Swietenia macrophylla*) trees in Central America have been shown to have less genetic variation in heavily logged sites than in unlogged sites.
- ▶ Dorset heathland is disappearing at 1.7% per annum due to scrub and tree succession rather than land use change.
- ▶ Guidelines have been developed for the management of Sahelian floodplains.
- ▶ A decision support system for habitat restoration has been delivered to MAFF, where it is now undergoing trials.



Prof. Steve Albon

Pest and Disease Control and Risk Assessment for GMOs



There is a serious need worldwide for more effective control agents for pests and diseases that are both sustainable and environmentally friendly.

The primary aims of Programme 6 are to assist in the provision of novel pest and disease control strategies whilst assessing any possible risk to the environment.

The Programme falls into two main themes:

- ▶ pest control
- ▶ animal disease control

Molecular biology is essential to much of the work which helps give this Programme a novel and progressive approach.

Programme Themes

- ▶ The development of sustainable insect pest management strategies
- ▶ Pathogen-derived genes for plant virus/vector management
- ▶ Environmental impact of GMOs and potentially invasive species
- ▶ Understanding and controlling arthropod-transmitted diseases
- ▶ Distribution of pathogens in freshwater

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Terrestrial Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Virology & Environmental Microbiology

Programme 6 research projects described in the 1997-98 Institute Scientific Reports

IFE

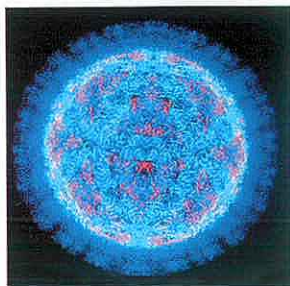
- ▶ Invasive aquatic plants

ITE

- ▶ Developing GMO risk assessments

IVEM

- ▶ The behaviour and risk assessment of genetically modified baculoviruses
- ▶ The ecology of baculoviruses in natural populations
- ▶ Phenotypic plasticity in disease resistance
- ▶ Development of improved inocula for the biocontrol of fungal pathogens of seedlings
- ▶ The biodiversity of mobile genetic elements, their role in bacterial adaptation and survival
- ▶ Pest and disease control and risk assessment for GMOs
- ▶ Tracing the origin of louping ill virus by molecular phylogenies
- ▶ Virulence genes in baculovirus
- ▶ The role of complement in Lyme disease ecology
- ▶ Tick transmitted pathogens in a seabird colony
- ▶ Bioactive tick salivary proteins



Programme Leader's Report

This Programme is concerned with the development of novel pest and disease control strategies. A multidisciplinary approach utilises expertise of CEH scientists in microbiology, molecular biology, ecology and mathematical modelling. This has enabled the integration of laboratory and field studies in a number of key areas exemplified below.

Many pest species of caterpillars develop different phenotypes depending on population density. Typically larvae in low density populations are cryptically coloured, while those in high density populations are darker, more active and pupate earlier. Laboratory experiments using larvae of the African armyworm, *Spodoptera exempta*, have shown that the black high density form is 12 times more resistant to baculoviruses than larvae reared at low density. A field trial has shown that virus is transmitted less readily between the insects reared at high density in the early stages of their development.

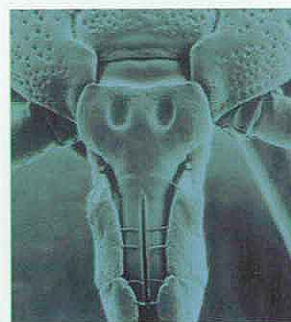
The plant surface has been the target of a number of releases of Genetically Modified Micro-organisms which have been introduced as mediators of plant protection or plant growth. A fluorescent pseudomonad isolate has been developed which is effective in the control of damping off disease caused by the fungus *Pythium* sp. Through study of its pathogenicity, the mode of action of the biological control agent (BCA) and its persistence in soils, it has been possible to target key stages in the life cycle of *Pythium* to optimise the biological control activity. The efficacy of the BCA has been further improved by introducing genes from other pseudomonads which express antifungal compounds not present in the original isolate.

Although plant viruses undoubtedly harm crops, very little is known about their prevalence and effects in wild plants. Virus infections have been studied in wild cabbage and mustard. Seventy-eight percent of cabbages and 35% of mustard plants had at least one virus. Multiple infections were also frequent, with 54% of cabbage and 12% of mustard plants having two or more viruses.

Further work is planned to investigate the effect of multiple virus infections.

Achievements

- ▶ Baculoviruses are less effective in killing insect hosts reared in high density
- ▶ An improved fluorescent pseudomonad has been developed for the control of damping off disease
- ▶ The incidence of viruses in wild cabbage and mustard has been measured

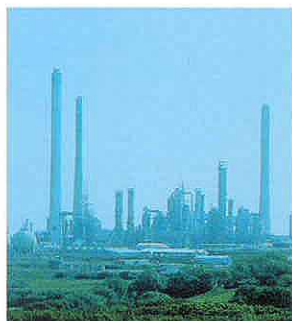


Scanning electron micrograph of the head of a tick



Prof. Bob Possee

Pollution



Recent years have seen the rapid development of legislation, at both national and international level, to regulate chemicals in the environment, particularly those pollutants known to produce adverse effects on the environment or on human health. Effective control of chemicals through legislation requires methodology to estimate the fate, hazard and risk associated with each chemical.

This Programme will develop a better understanding of generic processes such as transport processes, fluxes of pollutants and the fate of pollutants in order to predict more accurately the likely impacts on environments and organisms. The main elements of Programme 7 are:

- ▶ long-range transport of persistent organics and metals
- ▶ further development of the critical loads approach, particularly for acidifying pollutants
- ▶ environmental pollution and human health.

Programme Themes

- ▶ Radionuclides
- ▶ Acidifying pollutants
- ▶ Photochemical oxidants
- ▶ Toxic metals
- ▶ Organic pollutants

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology
- ▶ Institute of Virology & Environmental Microbiology

Programme 7 research projects described in the 1997-98 Institute Scientific Reports

IFE

- ▶ Reversal of surface water acidification in the Lake District
- ▶ Temporal change in fallout ^{137}Cs in terrestrial and aquatic systems: a whole ecosystem approach
- ▶ Micro-organic distributions in river sediments in the Humber catchment
- ▶ Predicting the potential for natural attenuation of organic pollutants in groundwater

ITE

- ▶ Radionuclide developments since Chernobyl

IH

- ▶ Phosphorus dynamics in the River Kennet
- ▶ Impact of pesticides on river ecology in headwater streams
- ▶ Modelling surface water acidification at the UK scale

IVEM

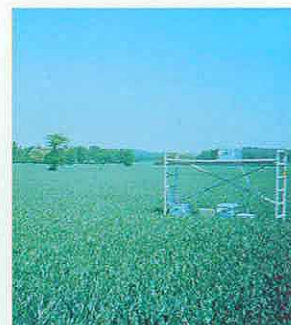
- ▶ Biodegradation of cyanide
- ▶ Bioelectrokinesis
- ▶ Microbial ecology of synthetic metal-working fluids



Programme Leader's Report

Regulation of the production, use and trade in chemicals continues to occupy a prime position in government thinking worldwide. As we approach the millennium and the targets for chemical review set in Chapter 19 of Agenda 21 in Rio, current achievements and future trends are being discussed extensively in a range of international fora. Agreement has been reached this year on transboundary controls on persistent organic pollutants (POPs) which seeks to prevent further input into the global environment of these old problem substances. Discussion on how to deal with existing residue redistribution, often to the Arctic, is underway. Strategies to reduce release of other airborne pollutants continue to evolve on an international basis. Risk assessment of new substances to agreed protocols is enshrined in legislation in all developed countries. Based on experience of past pollutants, work has started on the monumental task of assessing the tens of thousands of existing chemicals in industrial and domestic use to agreed protocols.

As work moves on from risk assessment to risk management, the impossibility of detailed discussion on all of these substances becomes more apparent. The way forward is currently being established in the UK through a consultation paper from the DETR "Sustainable production and use of chemicals", and in wider European and global consultation. Priority setting becomes key to the process. The CEH Science Programme on Pollution addresses issues of monitoring, fate modelling and effects assessment at individual, population and community levels to determine what our priorities should be.



Measurement of deposition and emission of atmospheric pollutants

Achievements:

- ▶ The first demonstration under realistic conditions that reaction of nitrogen dioxide and ozone is not pressure or concentration dependent - a crucial finding for models of atmospheric chemistry
- ▶ Development of the first predictive model for spatial variation in radioactive fallout over the Northern hemisphere
- ▶ Improved understanding of the links between sulphur and nitrogen deposition and acidification of soils and surface waters has allowed application of dynamic models to whole regions in the UK
- ▶ Demonstration that persistent organic contaminant concentrations depend heavily on seasonal and between year variation in river flow



Dr. Stuart Dobson

Environmental Risks and Extreme Events



The 1990s have been designated as the International Decade for Natural Disaster Reduction (IDNDR). CEH is contributing significantly to this through its programme of research into the prediction of extreme natural events such as floods and droughts. These are disasters affecting millions of people and causing billions of pounds worth of damage annually around the world. In addition, other unusual unpredictable events such as fire, strong winds and temperature extremes can often have dramatic effects on ecological communities.

This research Programme is contributing to an understanding of how environmental extremes affect mankind and the natural environment and is developing quantitative predictive tools to describe these effects.

Programme Themes

- ▶ Risk assessment and estimation of floods and other extreme events
- ▶ Real-time and water quality forecasting and decision support systems
- ▶ Understanding and modelling the role of rare events on ecological systems

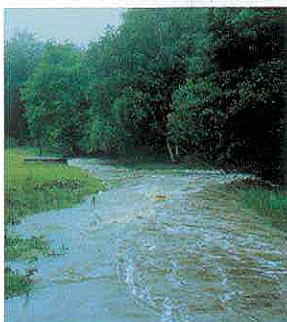
Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology
- ▶ Institute of Virology & Environmental Microbiology

Programme 8 research projects described in the 1997-98 Institute Scientific Reports

IH

- ▶ HYREX: Hydrological Radar Experiment
- ▶ Digital data and the Flood Estimation Handbook - an example



Programme Leader's Report

The science of Programme 8 aims to improve our understanding of extremes in the environment and to develop methodology for better assessment, estimation and forecasting of these extremes. At CEH's Institute of Hydrology the focus has traditionally concerned the extremes of floods and droughts for application in design (including reservoirs, culverts, drainage and flood alleviation schemes), flood warning and water supply. Through a new CEH Integrating Fund project collaborative links have been established with CEH's Institute of Freshwater Ecology and Institute of Terrestrial Ecology with a view to identifying areas where hydrometeorological extremes expose ecological systems to stress and in turn affect population numbers and species assemblages. Three science areas have been selected for initial study:

- ▶ The effect of drought, wildfire and waterlogging on heathland plant populations
- ▶ Modelling the effect of drought on brown trout populations
- ▶ The impact of lake hydrology on the survival of the rare vendace (fish)

One of the outputs from CEH research on rainfall and flood frequency estimation is the Flood Estimation Handbook (in five volumes and accompanying software) which provides a guide to best practice in the UK. This will be formally released in 1999. Much of the strength of the Flood Estimation Handbook lies in the practical and integrated nature of the methods and datasets developed to provide new general procedures for rainfall and flood frequency estimation in the UK. It includes new research on UK flood trends and the mapping of rainfall in hilly terrain.

Two of the major challenges in the science of flood forecasting are to incorporate the effect of snowmelt where this is important, and to place confidence limits on forecasts. Separate models have been developed within CEH to address these problems. The elevation-dependent snowmelt model makes use of the CEH digital terrain map and can predict the moving snowline within a catchment.

Achievements

- ▶ A model for forecasting the impact of drought on total number and age structure of trout populations has been developed which shows that drought conditions result in lower stocks than previously expected
- ▶ Completion of a pilot study for flood frequency estimation by continuous rainfall-runoff modelling
- ▶ A new elevation-dependent snowmelt model has been developed which gives much improved performance in forecasting flood flows, and has been applied to catchments in Scotland and north-east England

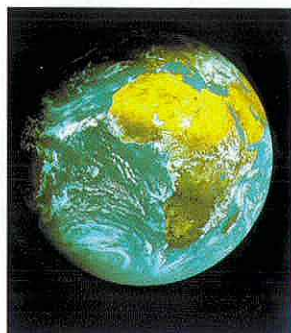


A wildfire on Dorset heathland



Dr. Bob Moore

Global Change



Many changes are occurring globally as a result of man's activities. Some, such as losses of biodiversity, freshwater eutrophication and the emission of short-lived air pollutants, are occurring simultaneously in many places and their local or regional impacts are seen repeated around the world. Others, such as industrial activity, deforestation and desertification, occur locally but cause long-term significant changes directly or indirectly to the atmosphere or oceans, so that their effects persist and are seen globally – these global changes are the main focus of this Programme.

Programme 9 is reducing the uncertainty in the magnitude of global change and its impacts. The research is focused on improving the accuracy of global change predictions through:

- ▶ improving our knowledge of greenhouse gas budgets and land-atmosphere interactions
- ▶ forecasting global change impacts on species, ecosystems and water resources

Programme Themes

- ▶ Greenhouse gas budgets and cycles
- ▶ Land-atmospheric-ocean interactions
- ▶ Forecasting and detecting the impacts of global change

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology

Programme 9 research projects described in the 1997-98 Institute Scientific Reports

IFE

- ▶ The influence of long-term changes in the weather on the overwintering performance of lake zooplankton

ITE

- ▶ Development of interactive GCM-biome models
- ▶ The application of remote sensing to global processes
- ▶ Impacts of climate change on UK species and communities

IH

- ▶ Arctic hydrology
- ▶ Impact of climate change on river flooding in the UK



Programme Leader's Report

Global warming looks increasingly real. Globally, 1997 was the warmest year on record and the El Niño Southern Oscillation was the longest and most intense known, causing damaging droughts and floods around the Pacific rim. In the UK, August 1997 saw record high temperatures.

Internationally, the most significant event during the year was the meeting in Kyoto in December 1997, when 36 (Annex I) nations agreed an overall 5.2% reduction in greenhouse gas emissions from 1990 levels by 2008-2012. This event was significant for CEH because it reinforced and extended the need for information on greenhouse gases, their effect on climate and its impacts.

If implemented the Kyoto Protocol will reduce warming in 2100 by only about 8% below business-as-usual. Is this enough and what should the next Protocol aim for? We need to understand more about the national and global sources and sinks of methane and nitrous oxide, as well as of carbon dioxide. Annex I countries will be permitted to reduce their emissions by increasing net carbon sequestration in terrestrial sinks (via afforestation and reforestation) as well as by cutting fossil fuel emissions. This raises questions about how to quantify and verify changes in the store of carbon in forests and on how to keep comprehensive accounts, nationally and globally, of carbon stored in vegetation, soils and forest products.

The NERC TIGER programme ended during the year. Initiatives to sustain CEH research in this area include involvement in 15 EU consortia working on issues related to climate change, including work in the tundra (LAPP), the Amazon (EUSTACH), on global modelling (ETEMA, ESCOBA), forest responses (CLIMEX, ECOCRAFT, LTEEF, RECOGNITION), grasslands (MEGARICH, RANGELANDS, Climate and Degradation), moorlands (CLIMOOD), hydrology and freshwaters (BASIS, REFLECT, CLIMFRESH).



Controlled environment chamber for varying temperature and atmospheric CO₂

Achievements

- ▶ Modelling of global ecosystems suggest that the terrestrial carbon sink will increase until about 2070, but may then collapse as high temperatures and droughts cause forest dieback in areas of the tropics
- ▶ Measurements taken using aircraft have enabled the entire UK emissions of methane and nitrous oxide to be estimated on particular days, and suggest that nitrous oxide emissions may be much larger than currently estimated
- ▶ Models suggest that about half of the increased growth rate of UK forests may be due to increased carbon dioxide concentrations and nitrogen deposition
- ▶ Soil moisture has been modelled on a 50m grid for investigating the ecological impacts of climatic change



Prof. Melvin Cannell

Integrating Generic Science



This Programme has been designed to provide a research framework for those areas of CEH science that underpin the nine other Programmes. These activities are cross-cutting, often dealing with new and innovative technology. The fundamental work undertaken on environmental monitoring and data management falls into this Programme, as well as development of new methods for interpreting and manipulating complex data. Development of new instruments and sensors, essential for progress in environmental sciences, is a well-established CEH activity and forms part of this Programme.

Programme 10 undertakes research in its own right, as well as providing data and technological support to the other CEH Science Programmes.

Programme Themes

- ▶ Environmental assessment, economics and history
- ▶ Remote sensing
- ▶ Instrumentation
- ▶ Biotechnology development
- ▶ Analytical chemistry
- ▶ Databases and reference collections
- ▶ Biometrical applications, research and development

Participating CEH Institutes

- ▶ Institute of Freshwater Ecology
- ▶ Institute of Hydrology
- ▶ Institute of Terrestrial Ecology
- ▶ Institute of Virology and Environmental Microbiology

Programme 10 research projects described in the 1997-98 Institute Scientific Reports

IFE

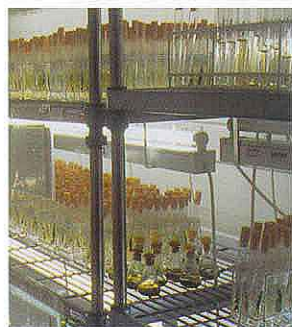
- ▶ Automatic water quality monitoring
- ▶ Establishing an IFE data centre
- ▶ Mayflies new to Great Britain

IH

- ▶ European rivers and catchments (ERICA)

IVEM

- ▶ BIOMATE
- ▶ PRIVEM
- ▶ Gene vector development



Programme Leader's Report

Within the Instrumentation theme, significant progress has been made on the development of dielectric sensors for the measurement of soil water. The response of various different dielectric sensors to soil water content, dry bulk density, electrical conductivity and bound water has been measured. As a result it has been possible to show that:

- ▶ electrical conductivity affects the real part of the permittivity in clay soils
- ▶ different dielectric sensors respond to electrical conductivity of soil in different ways
- ▶ an estimate of the permittivity and thickness of bound water can be obtained

Developments in the application of analytical instruments and methods for environmental research are fundamental to the research programmes in CEH. Four methods for the analysis of total dissolved phosphorus in soil solutions were assessed. A mild persulfate digestion gave the most reliable and accurate results, whereas two strong oxidation procedures (peroxide-Kjeldahl and nitric acid-sulfuric acid) gave erratic recoveries and were vulnerable to contamination. Inductively coupled plasma - optical emission spectrometry (ICP-OES) lacked the sensitivity to determine P concentrations below 100 mg l⁻¹.

Because vast amounts of data can now be rapidly accumulated from the environment, delivering these data in a useful form is now a major challenge. The NERC Data Centres have addressed this problem by publishing the first of a series of CD-ROMs containing outputs from the NERC LOIS (Land Ocean Interaction Study) Thematic Programme. The overview CD includes demonstrations of the output and analysis of models and remotely sensed images. The Culture Collection for Algae and Protozoa (CCAP) has tackled the same challenge in a different way. It has developed a database which will be integrated into the UK National Culture Collection (UKNCC) presence on the Internet and allow the scientific community, worldwide, to search the holdings of all the CCAP Collections.

Achievements.

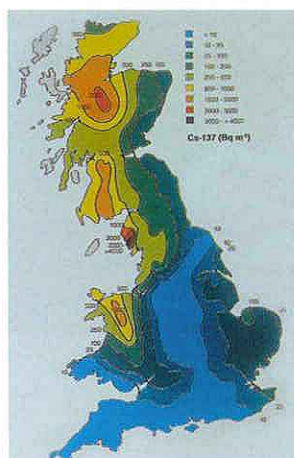
- ▶ The development of the CLEVER system using Vector- and Raster-mapping to improve the accuracy of land cover classification
- ▶ A new statistical method for detecting density dependence in populations by incorporating weather data in the analysis
- ▶ Archive data has been used to describe the inception and development of the new National Forest in the Midlands



Multi-spectral
phytoplankton biomass
sensor developed by
CEH's IFE



Prof. John Hilton



With the wide range of internal scientific expertise available, CEH is able to adopt an holistic approach to scientific research across the freshwater and terrestrial sciences - as exemplified by its Science Programme.

Since its formation in 1994, CEH has undertaken several initiatives to further integrate the work of its component institutes. Two of the most important of these initiatives are the Integrating Fund Projects and the Networks. This section describes these activities in more detail.

Integrating Fund Projects

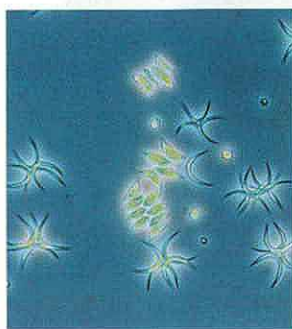
Integrating Fund Projects were implemented in 1995 to assist the development of cross-disciplinary research throughout CEH. To date 21 projects, (see table on opposite page) each involving at least 2 collaborating Institutes, have been funded and from these new and exciting scientific discoveries have begun to emerge. Examples of these are listed below.

Current Outputs from Round 1:

- ▶ Methods have been developed for the prediction of long-term radiocaesium contamination of surface waters and vegetation after a nuclear accident
- ▶ Indication that the growth of a young, temperate forest results in changes in the levels of evaporation and chemical cycling in vegetation and soils but has no obvious effect on stream water chemistry or biology prior to entire canopy closure
- ▶ Demonstration that viral loads have a negative effect on the biomass and fitness of cabbage
- ▶ Development of microbial systems for evaluating the fate and impact of pollutants on soils
- ▶ Development of models describing the effects of climate change on carbon exchange between the atmosphere and tropical rainforests and savannah

Current Outputs from Round 2:

- ▶ Development of novel approaches for incorporating socio-economic and social factors into an integrated environmental analysis
- ▶ Microbial diversity in an aquatic ecosystem is never so impoverished that it cannot play its full part in biogeochemical cycling
- ▶ A method has been developed for viral concentration, purification and detection from environmental freshwater samples
- ▶ The development of the main components of a prototype system designed to facilitate the use of CEH models and datasets and to apply them to the solution of complex environmental problems



Round 1 (1995/96 - 1998/99)	IFE	IH	ITE	IVEM
The microbial basis of methane (CH ₄) oxidation in soils	•		•	•
Microbial diversity and ecosystem function - Phase I	•		•	•
Interactions of viruses, aphids and wild <i>Brassica</i> (extended for a further year)			•	•
Combined growth and water use modelling of mixed vegetation		•	•	
Molecular genetics & process-level events in the biodegradation of xenobiotics in rhizosphere soils			•	•
Modelling the chemical availability of radionuclides in upland organic soils (extended for a further year)	•		•	
Upland forest closure - its significance for chemistry, ecology & hydrology	•	•	•	

Round 2 (1996/97 - 1999/00)	IFE	IH	ITE	IVEM
The role of seabirds in the epizootiology of Lyme Disease			•	•
Combined hydro-ecological and socio-economic models of land use, land management & environmental degradation (CHASM)	•	•	•	
The environmental characteristics of urban environments	•	•	•	
Microbial diversity and ecosystem function - Phase II	•		•	•
Enhanced access to spatio-temporal information on environmental resources (EASIER)	•	•	•	
Modelling the transport and fate of viruses in the aquatic environment		•		•

Round 3 (1997/98 - 2000/01)	IFE	IH	ITE	IVEM
Directly monitoring gene activity during periods of environmental change			•	•
Modelling, risk estimation & management of ecological systems subject to natural hazards	•	•	•	
Development of a catchment scale model of phosphorus sources movement and fluxes	•	•	•	

Round 4 (1998/99-2001/02)	IFE	IH	ITE	IVEM
The genetics and ecology of salmon decline in chalk streams	•		•	
The population dynamics of fragmented-plant-insect pathogen systems: Implications for sustainable pest management			•	•
Development of an integrated hydro-ecological model (IHEM) for global change research		•	•	
Bio-energetic response to habitat by salmon and brown trout juveniles	•	•		
Spatial variability of interacting biological and hydrological processes in the Arctic		•	•	

CEH Networks

CEH has also supported the creation of dedicated internal networks to manage and promote our activities in relation to specific environmental and scientific issues.

The CEH Oil Network

CEH staff have experience investigating the issues concerned with the environmental impact of pollution by oil and other hydrocarbons - particularly their effect on the freshwater and terrestrial environments (including the near shore area). Areas of expertise include:

- ▶ Development and use of bioremediation techniques
- ▶ Application of monitoring techniques and equipment
- ▶ Production of contingency plans
- ▶ Provision of ecological assessment and advice

The Oil Network was formed to co-ordinate CEH activities in this field and to provide a range of applied environmental services backed up by sound scientific research.

A programme is under way to raise awareness of the CEH Oil Network in the oil industry and associated service industries, local government, the statutory environmental organisations, and conservation bodies.

The convenor of The CEH Oil Network is Jim Conroy, ITE Banchory.

UK Arctic Network (UKAN)

In early 1998 CEH brought together its own experts with selected UK university scientists to discuss developments in ecological and hydrological research in the Arctic. The rationale behind the meeting was to discuss a multidisciplinary approach to new Arctic research initiatives and to search for the appropriate funds. This meeting resulted in the establishment of the UK Arctic Network (UKAN) which is being run by CEH. The aim of UKAN is to highlight important issues in arctic ecology/hydrology/geomorphology and to develop suitable research programmes.

The strengths of the Network include a multi-disciplinary group, with a capability of handling projects at different scales, expertise in modelling, remote sensing and terrestrial ecology. Using this expertise as a base UKAN identified four areas of Arctic research for primary consideration:

- ▶ Climate change
- ▶ Pollution and contamination
- ▶ Human impact
- ▶ Biodiversity (covering conservation & education)

It is envisaged that this Network will develop as a focal point for UK-based Arctic environmental research.

This Network is led by Prof. Steve Albon, ITE Banchory.



The CEH Earth Observation Network

The formation of the CEH Earth Observation Network has formalised long-established contacts to allow strategic planning and collaborative research. Meetings have discussed current projects and considered additional parameters which CEH could measure by remote sensing. The Network is developing a CEH Earth Observation strategy which will aim to:

- ▶ Undertake basic, underpinning, research into the properties of EO data
- ▶ Research, develop and test methods for analysis of such data
- ▶ Apply EO for mapping and/or measurement of biophysical variables
- ▶ Use outputs to take stock and measure change; to understand, model and predict processes; thereby to inform end-users in environmental planning, exploitation and management
- ▶ Advise and support CEH, NERC, British National Space Centre and customers regarding EO systems
- ▶ Acquire, and make available, key images, in support of CEH work.

Within this strategy the Network will continue to:

- ▶ Assess user needs across CEH
- ▶ Recommend new collaborative research and pursue externally funded work

The CEH Earth Observation Network is led by Robin Fuller, ITE Monks Wood.



Wetlands Research Co-ordination Group

Over the past five years wetlands have been recognised increasingly as important and valuable ecosystems, holding equal status with rainforests and oceans. Demands for sustainable management, conservation and restoration of wetlands are developing more quickly than wetland research and numerous gaps in fundamental understanding are evident.

The future of wetlands, both in the UK and overseas, must be based on sound science. CEH is well placed undertake the multidisciplinary research that this requires and to advise on wetland management and policy development.

A Wetland Research Co-ordination Group was created in early November 1997 to bring together staff involved or interested in this area of research. The aim of this network is to build on existing expertise and establish CEH in a prominent role in the arena of national and international wetlands research. Initial discussions have focused on the development of a Wetlands Research Strategy, which includes:

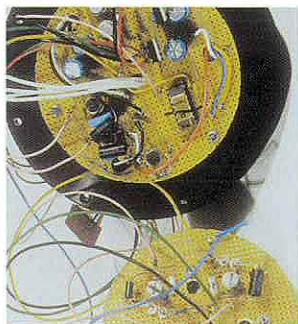
- ▶ Definition of wetlands (from a CEH research view point)
- ▶ Identification of core research areas, such as process studies, modelling, management, restoration and networking
- ▶ A communications strategy and outline project proposals

This Network is led by Dr. Mike Acreman, IH.



CEH Engineering and Instrumentation Network

CEH staff involved in engineering and instrumentation are concentrated mainly at CEH's Wallingford and Windermere sites, with some staff at other sites. The main objective of the CEH Engineering and Instrumentation Network is to provide contact points for these staff to share knowledge and experience in solving engineering problems, and to provide a platform for discussing different working methods with the aim of spreading good practice.



The network meetings have served to reinforce existing contacts between staff and establish new ones, to view the facilities, range of work and expertise and to discuss a number of items of shared concern. These have included environmental logger selection, EMC compliance, workshop practices and staffing structures. A direct result of the meetings has been a CEH Integrating Fund bid (with another one under discussion) and a strengthening of direct contacts between staff on engineering problems.

This Network is led by David Cooper, IH.

CEH Data Network

CEH manages two NERC Designated Data Centres (DDCs) - the Environmental Information Centre (terrestrial data) and the National Water Archive. These DDCs provide advice and guidance to potential users on data accessibility and suitable support systems. In addition CEH's research activities continue to generate large volumes of a variety of scientific data.

Meetings of data managers throughout CEH are held to inform and make recommendations to the Director on new collective opportunities and the management of data within CEH.

Topics discussed included the:

- ▶ Strategic funding of data maintenance and dissemination
- ▶ Varying quality of metadata and its dissemination
- ▶ Potential for data exploitation and the possible impediments

High quality data is now being recognised as a valuable resource. CEH is an important repository for the management and dissemination of a large range of datasets.

This Network is led by Martin Lees, IH.

CEH Analytical Chemistry Network

This newly-established network builds on a long history of collaboration among chemists in CEH Institutes. It brings together chemists who run analytical services for other CEH researchers with those who undertake their own specialised research. In this way, the most effective use can be made of CEH analytical facilities; equipment can be matched to user needs, and to the different expertise at different CEH sites. Advice is also given on the acquisition and deployment of novel analytical techniques.



This Network is led by Dr. Neil Cape, ITE Edinburgh.





Measuring our Performance

CEH collects an extensive database of indicators that are used to assess how well the Centre is contributing to the mission of NERC. CEH has an excellent record in all areas and some statistics are given in the following section of this report. These quantitative and qualitative measures of activity and performance include:

- ▶ Measures of science output - e.g. publications and commissioned reports
- ▶ Scientific achievements and highlights - contributions to scientific knowledge
- ▶ Inputs to the user community - contribution to government consultations, membership of decision making committees
- ▶ Services to the scientific community - e.g. books edited, grants refereed, university links
- ▶ Education and training - e.g. students supported, lectures given and workshops held
- ▶ Technology development - e.g. new hardware, software and techniques developed, licence agreements, spin-off companies
- ▶ Public understanding of science - media appearances, newspaper articles, general publications

Publications

Publications are one of the most important statistics used to measure scientific performance. CEH has a consistently high record of achievement through publications, both in the scientific literature and in the form of commissioned reports, as shown in Figure 1.

CEH also measures scientific performance across the 10 Programme areas. This is important for demonstrating the impact and relevance of the individual Science Programmes. Figure 2 shows, for each Science Programme, the publication output (peer-reviewed publications and Commissioned Research reports) for 1997.



Figure 1 - CEH publications since 1992

A system increasingly used for assessing cost effectiveness is to calculate the cost per paper. CEH calculates both the Science Budget cost per paper for peer-reviewed publications alone and also combined with Commissioned Research reports (Figure 3). This demonstrates the added value gained from a given amount of Science Budget (Core Strategic) funding. Indeed, across NERC as a whole, CEH's publication performance is one of the most cost-effective.

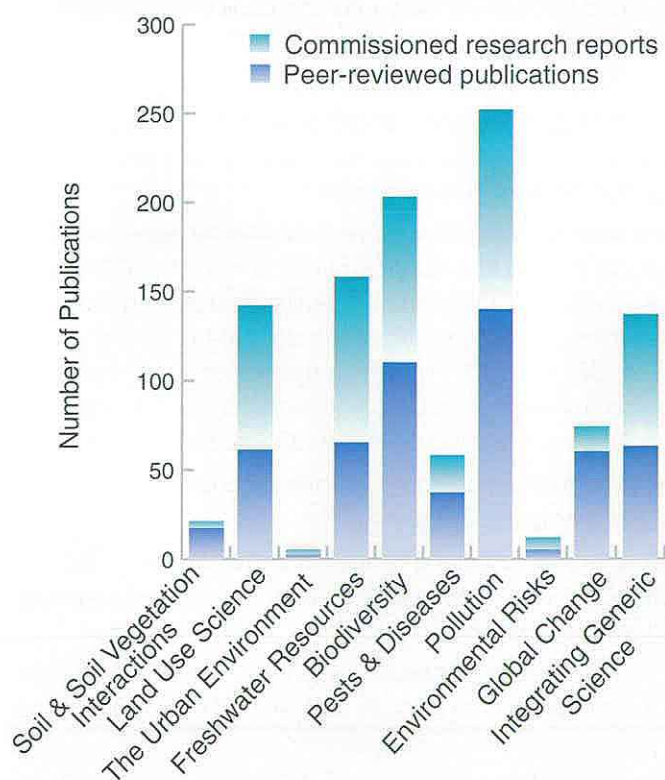


Figure 2 - publications per Science Programme 1997

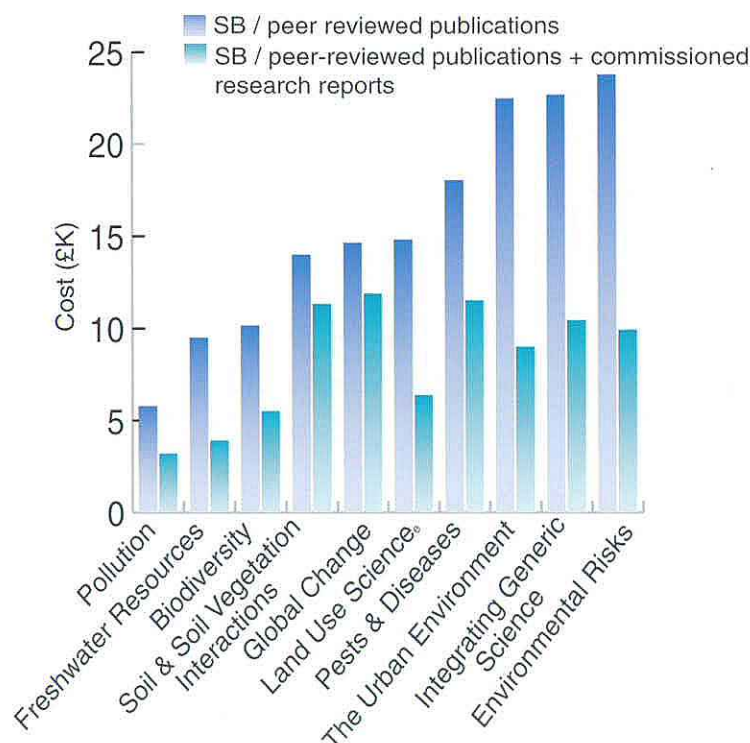


Figure 3. Science Budget cost per article

Influence

The level and range of scientific expertise held throughout the component CEH Institutes is highly regarded throughout the world and CEH's scientific knowledge influences a wide range of user groups.

For example, in the past year CEH has provided evidence to Parliamentary Select Committee Inquiries on Sewage Treatment and Disposal and Management of Nuclear Waste, and has provided the Environment Agency with information on flood prevention using our 100-year flood risk map.

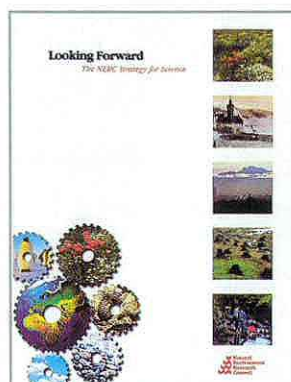
CEH continues to build strong academic links and has formal agreements with 19 universities, which include several Memoranda of Understanding. CEH also collaborates extensively with industry - recently, digitised floodplain data was released to insurance brokers for incorporation into their in-house risk assessment procedures. CEH has considerable influence on many national and international key decision-making committees (Appendix 6) and members of our scientific staff are named in the list of top European Environmental Scientists.

CEH scientists are involved in most of the major international environmental science programmes. As examples, CEH:

- ▶ provides the secretariat for Focus 3 Global Change and Terrestrial ecosystems (GCTE), a core activity of the International Geosphere and Biosphere Programme (IGBP)
- ▶ has contributed to a series of technical workshops on flood forecasting in China as part of the International Decade for Natural Disaster Reduction (IDNDR)
- ▶ has been invited by the World Meteorological Organisation (WMO) to host an international seminar on hydrological data in support of its Hydrology and Water Resources Programme (HWRP)



CEH Contribution to NERC Objectives



The NERC science strategy for the next 5 to 10 years is outlined in the publication "Looking Forward". This document integrates the sectoral strategies produced by each of the NERC Science and Technology Boards, and combines these with the output from the UK government's Foresight programme and the views of other key users of science.

From such considerations NERC has identified 5 major environmental issues and 8 Strategic Aims. CEH actively addresses these aims and issues through its Science Programme. The following section describes the CEH contribution to these aims and issues.

NERC Strategic Aims

NERC has produced 8 Strategic Aims to deliver its mission statement. The CEH inputs to these Strategic Aims are quantified below.

Knowledge

Support high quality research and technology and maintain long-term capability; understand and predict the environment, natural resources and their response to change;

- ▶ 442 scientists, including 11 Individual Merit Promotions
- ▶ 431 refereed publications (ISI listed)
- ▶ 108 refereed publications (non-ISI listed)
- ▶ 9 books
- ▶ 7 books edited
- ▶ 130 book chapters
- ▶ 436 Commissioned Research reports
- ▶ 22 software packages in the market place
- ▶ staff expertise in 12 major scientific specialities
- ▶ highest percentage of refereed publications for NERC Centre / Surveys
- ▶ 76% of scientific papers are refereed

People

Foster the health and vitality of the UK environmental science skills base through education, training and career development;

- ▶ 19 universities have formal links with CEH
- ▶ 25 members of CEH are visiting professors
- ▶ 113 PhDs supervised
- ▶ 55 CEH staff acted as external examiners
- ▶ 402 students are hosted by CEH
- ▶ 400 lectures were given by CEH staff during the year
- ▶ 129 universities are partners in collaborative research projects



Data

Collect, manage and supply environmental data and provide information to meet the needs of users;

- ▶ CEH manages 2 NERC Designated Data Centres
- ▶ CEH manages the Culture Collection of Algae and Protozoa (CCAP)
- ▶ 2 NERC Thematic Data Programmes managed by CEH
- ▶ 2 representatives on the NERC Data Committee
- ▶ CEH curates many long term environmental data sets of national and international importance
- ▶ CEH manages the Environmental Change Network involving 14 partners

Advice

Provide objective, independent expert scientific advice and information to underpin national and international policy and sustainable growth;

- ▶ provided evidence to 4 Parliamentary select committees
- ▶ 12 inputs to Departmental consultation documents
- ▶ 4 inputs to Ministerial briefings
- ▶ CEH representatives sit on 34 government and public sector scientific committees (Annex 6)

Facilities

Provide specialist scientific facilities and services to meet the needs of UK environmental sciences;

- ▶ 11 laboratories in different biogeographical zones
- ▶ dedicated analytical biological, chemical and microbiological laboratories
- ▶ CEH hosts NERC's Stable Isotope Facility
- ▶ 2 Environmental Change Network sites
- ▶ 2 Earth Observation Units
- ▶ 5 experimental catchments
- ▶ 1 fluvarium

Partnership

Work in partnership with users and other science suppliers and promote effective knowledge transfer;

- ▶ 30 jointly funded projects with industry
- ▶ 55 private sector research contracts
- ▶ 43 EU research projects ongoing
- ▶ 79 UK Government Department / Agency contracts
- ▶ 4 LINK Projects
- ▶ 350 licence agreements
- ▶ 1 spin-off company
- ▶ 6 NERC Thematic Programmes managed

Communication

Encourage public understanding of environmental issues and the role of science;

- ▶ 161 general publications
- ▶ 195 school activities
- ▶ 109 general public activities
- ▶ 45 media appearances

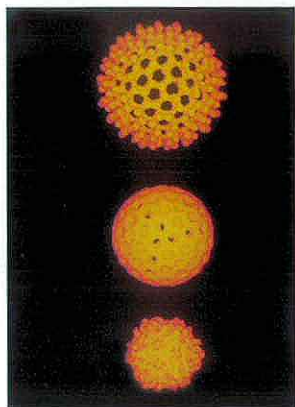
Efficiency

Ensure openness, accountability and value for money in the delivery of the NERC mission;

- ▶ lowest number of administration staff as a percentage of NERC Centre / Survey staff
- ▶ lowest Science Budget cost per refereed publication for NERC Centre / Survey (£15k)
- ▶ 4 independent Programme Review Groups



NERC Environmental Issues



The NERC strategic overview, "Looking Forward", focuses on 5 major issues concerning the environment and natural resources: biodiversity, environmental risks and hazards, global change, natural resource management, and pollution and waste. Within each of these issues, key areas of science are identified where there is a need to increase understanding.

The following section provides a **selection** of CEH achievements which demonstrate how we are contributing to NERC's objectives. Further details of these and other CEH achievements can be found within the CEH website (<http://www.ceb-nerc.ac.uk>).

Biodiversity

Key Area: Investigation of the extreme diversity of microbial communities and methods for culturing and isolation

- ▶ Cryo-electron microscopy is being used to study the structural diversity of viruses and the 3-D structure of cypoviruses (insect viruses) and of the BRDV tick-borne virus
- ▶ Evidence has been produced to support the concept of the global ubiquity of microbial species
- ▶ Fatty Acid Methyl Ester (FAME) analyses has been used to investigate species richness in freshwater bodies by providing FAME profiles of the different microbial communities

Key Area: How to underpin strategies for the management of threatened species

- ▶ A new population of the rare and endangered fish, the Schelly (*Coregonus lavaretus*), has been established in the Haweswater catchment

Key Area: The study of taxonomy and evolution including molecular approaches

- ▶ Molecular tools have been very successful in determining within-species genetic diversity of important tropical tree species which can be used in assessing the impact of logging

Key Area: Bioprospecting for useful natural compounds and materials

- ▶ Natural soil microflora which are able to degrade chlorobenzene pollutants have been identified
- ▶ Microbes with predictable responses to phenol have been isolated and genetically modified to carry genes for bioluminescence to allow development of pollution biosensors



Key Area: Understanding the interactions of natural populations and communities and their sustainable management

- ▶ Evidence has been gathered which shows that cycling grouse populations can be prevented from recovering from low densities due to predation by hen harriers and peregrines
- ▶ The re-parameterisation of a behavioural and individual-based model of oystercatchers preying on mussels has improved predictions of overwinter survival rates to within a percentage point or two of observed rates



Environmental Risks and Hazards

Key Area: Improved forecasting of storms, floods and droughts and in relation to climate change

- ▶ Improved rainfall forecasts during convective storms over southern Britain have been obtained using multi-scan weather radar to update the atmospheric water content in real-time
- ▶ A semi-distributed rainfall runoff model has been applied to 40 UK catchments to estimate flood frequency by continuous simulation modelling
- ▶ Research has resulted in the publication of volumes dealing with rainfall frequency estimation and also statistical flood estimation procedures for the Flood Estimation Handbook
- ▶ An elevation-dependent snowmelt model has been developed for UK catchments which can predict the impact of snowmelt on the flood hydrograph to support flood warning

Key Area: The ecology and risk assessment of both non-native and genetically modified organisms

- ▶ Demonstration that although insect resistance is advantageous to feral rape populations during colonisation of disturbed ground it may not result in greater persistence of feral rape populations
- ▶ Studies showing that genetically modified baculoviruses cause pest insects to fall onto the ground before dying (a difference from death due to non-modified viruses) have implications both for risk assessment and for effectiveness as a control agent





Global Change

Key Area: The coupling of carbon, nitrogen and water cycles to underpin global change research

- ▶ A complete national carbon budget has been produced using carbon-accounting models and existing databases

Key Area: Whole ecosystem response to climate change

- ▶ Results from the CLIMEX project suggest a potential switch from the boreal forest ecosystem acting as a net CO₂ sink to a net CO₂ source in response to warming
- ▶ Using the 'business-as-usual' scenario CEH's Hybrid model has predicted the collapse of the terrestrial carbon sink after 2070 due to widespread forest decline in the tropics
- ▶ A long-term study of Dorset heathland between 1978 and 1996 has shown dramatic changes in plant community structure in response to drought

Natural Resource Management

Key Area: Understanding the dynamics of individual species and populations to underpin sustainable exploitation

- ▶ A new growth model for brown trout has been applied and validated for use with other European freshwater fish (salmon, char, and perch)
- ▶ Radio-tagging studies of dace in the River Frome have for the first time revealed a period of post spawning starvation during which the fish inhabit the small tributaries of the main river system

Key Area: The environmental impact of land use change

- ▶ Predictive models have been used to assess the implications of land use change on species distributions and dynamics within landscapes
- ▶ Research has shown that the scheme of rotational set-aside provides extremely good habitat for farmland birds with few agronomic side effects for farmers
- ▶ Models have been developed to describe the changes that will occur in the ecology and hydrology of urban areas in response to different policies for land and water management.



Pollution and Waste

Key Area: **Information on the biogeochemical cycling of pollutants to inform waste management guidelines**

- ▶ Emissions of NO from agricultural soils have been shown to be larger than expected which has resulted in major revisions to the N budget for the UK
- ▶ Characterisation and assessment of complex pollutants, including endocrine disrupters
- ▶ Studies have shown that environmental oestrogens may increase oestrogen receptor sensitivity in fish



Key Area: **Integrated water quality models for fresh water**

- ▶ PROTECH-C, a computer simulation model of algal growth capacity, has been developed to simulate the *in situ* dynamics of phytoplankton in lakes, reservoirs and rivers
- ▶ A comprehensive sampling programme to monitor water quality and planktonic communities in Lake Tanganyika will, for the first time, permit a coherent study of the impact of pollution on the biodiversity of this internationally important water body

Key Area: **Remediation of contaminated land**

- ▶ Bioremediation methods for oiled beach sand have been developed and are being incorporated into management guidelines for local authorities
- ▶ Remediation methods are being developed to deal with soils co-contaminated with metals and organic compounds, such as mining wastes

Key Area: **The long-term fate of pollutants, including radioactive substances**

- ▶ The long-term decline in ^{137}Cs has been quantitatively linked to soil fixation processes for the first time, and a generic model has been developed for the transfer of radiostrontium to milk
- ▶ Pan-European critical loads maps for radionuclides have been produced
- ▶ Spatial analysis and modelling of radionuclides have been used to produce decision support systems and define appropriate countermeasures in the event of nuclear accidents

Key Area: **Urban atmospheric chemistry**

- ▶ The latest version of the Photochemical Review Group report has been produced - a major document summarising the current state of knowledge in the UK



Finance

Science Budget

In 1997/98 the value of the CEH baseline Science Budget, which underpins the CEH Science Programme and contributes towards the costs of infrastructure, remained broadly static in cash terms (i.e. declined in real terms). The overall effect was, however, disguised by an increase in the allocation to fund and manage computer support functions for the whole of CEH. These were formerly part of the NERC Scientific Services, transferred to CEH control on 1 April 1997. The year on year summary to date, including both the first four years of operation of CEH and the comparable figures for the year prior to the formation of CEH, is included in Figure 4.

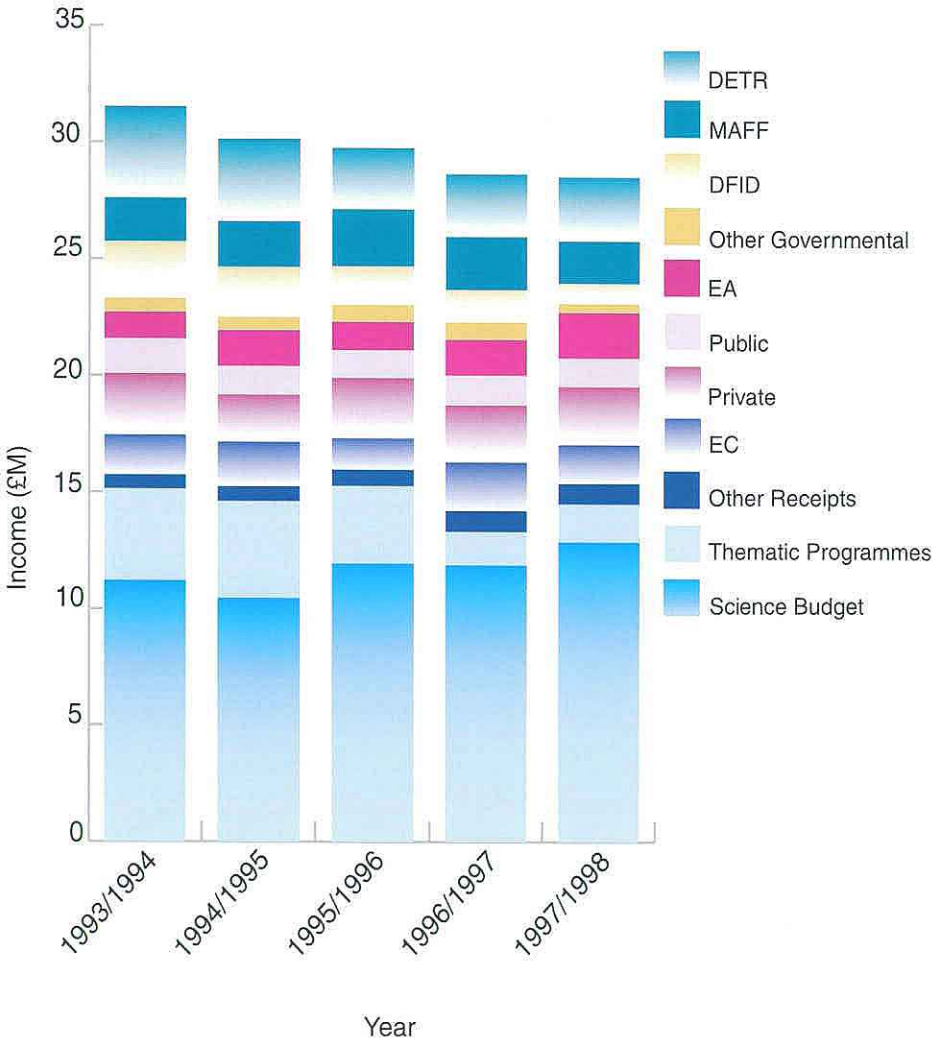


Figure 4. CEH Sources of Income (expressed in current prices)

The allocation by CEH to support the Science Programme and a proportion of infrastructure in the CEH Institutes has also remained broadly static in cash terms. This is not immediately apparent from the financial summaries for each Institute (Appendix 4), partly in view of the injection of additional funds to support development of the new Science Programmes and Integrating Fund projects and partly due to cash flow support to manage end of year income/expenditure fluctuations.

Integrating Fund

Seven Integrating Fund projects were supported in 1995/96 and the initiative was rolled forward into 1996/97, with a further six projects being supported at a total cost of £1.2M over three years. Funding of £0.7M over three years was allocated for a third round of Integrating Fund projects starting in 1997/98, supporting three projects, and a fourth cycle is due to begin in 1998/99.

Thematic Programmes

The level of support gained by CEH from Thematic Programmes has stabilised, but at a significantly lower level than was the case when the major TIGER and LOIS programmes were running. The financial difficulties faced as a result of the winding down of TIGER and LOIS have been managed by reductions in expenditure, redirection of scientific activity and support from central NERC funds.

Opportunities will arise under the new programme on Biological Diversity and Ecosystem Function in Soils (Soil Biodiversity) starting in 1998/99 and, subject to the implementation of the recommendations from the Government's Comprehensive Spending Review, under a new programme on Global Nitrogen Enrichment (GANE), which will start in 1999/2000.

In 1997/98 CEH institutes received funding under the following NERC's programmes:

- Terrestrial Initiative in Global Environmental Research (TIGER)
- Land Ocean Interaction Study (LOIS)
- Wildlife Diseases
- Hydrological Radar Experiment (HYREX)
- Large Scale Processes in Ecology and Hydrology
- Environmental Diagnostics
- Ecological Dynamics and Genes (EDGE)
- Atmospheric Chemistry Studies in the Oceanic Environment (ACSOE)
- Urban Regeneration and the Environment (URGENT)
- Stewardship and Exploitation of Environmental Data (SEEDCORN)
- Biological Diversity and Ecosystem Function in Soils (Programme management)



Non-Thematic Programmes

The limited opening of the Non-Thematic funding mode to Centres/Surveys brought income of c£80k to CEH institutes in 1996/97. Income in 1997/98, as early awards began to take effect, amounted to c£300k. This support does not cover the overhead costs nor the time and costs of principal investigators. These costs have to be met from elsewhere in the CEH budget.

Infrastructure

During 1997/98 the balance of Science Budget support has shifted towards support of the Science Programme, mainly as a result of savings in expenditure. A high proportion of infrastructure costs (c43%) is met from commissioned research, other external income and by way of contributions from Thematic Programme awards.

Commissioned Research and Other Income

CEH derives, and will continue to derive, a substantial proportion of its income from research commissioned by external customers (CR) and other sources.

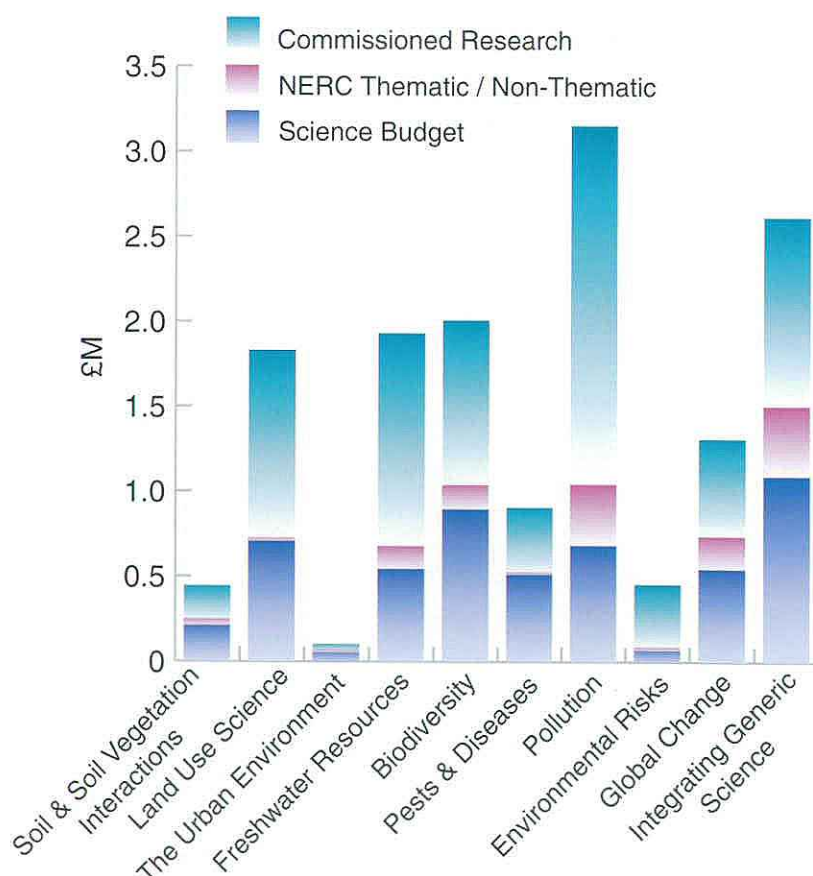


Figure 5. Major sources of CEH Income by Science Programme 1997/98

Figure 4 shows the overall contribution of external income to the CEH budget, and Appendix 4 shows Institute receipts from major customers in 1997/98, with the receipts in earlier years, revalued to current prices, for the purposes of comparison. Research funding from traditional customers in the UK Government and public sectors is either static or declining and new sources of income are being actively sought. Work on European Commission programmes continues to be important, although the requirement to identify funds to match EC contributions on EC supported contracts is a limiting factor in increasing this funding stream.

Science Programme

The new CEH Science Programme was formally implemented on 1 April 1997. It is mutually dependent on both Science Budget and external funding. Work funded by external customers adds value to the science base and is reflected in the overall value of the Programme. As a result of delays in the introduction of the new NERC accounting system, however, actual expenditure will not be shown under the new programme definitions until 1998/99. Broad analyses of expenditure (cash and percentage) in the ten programme areas in 1997/98, prepared for planning purposes, are shown at Figures 5 and 6.

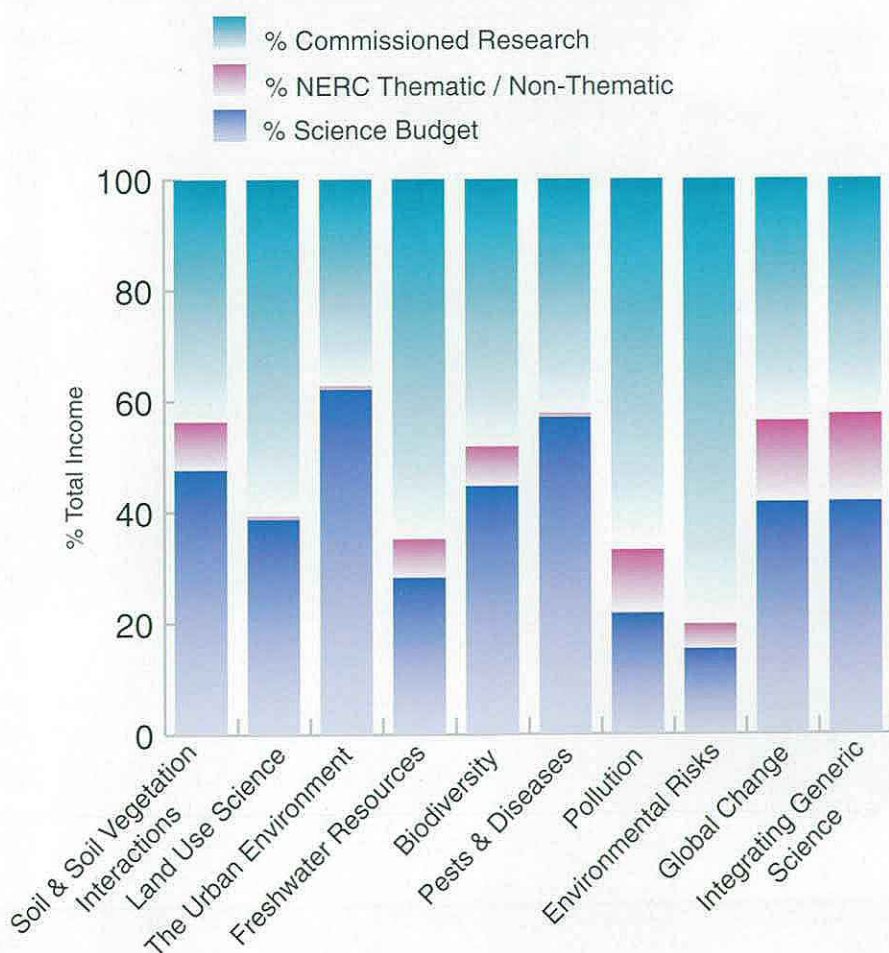


Figure 6. CEH Income sources as a percentage of each Science Programme



Staffing

The spread of skills of current CEH scientific staff (Figure 7) reflects changes which have emerged, and will continue to emerge, in the balance of activities required to support the CEH Science Programme. Following the loss of 21 staff in 1995/96, 12 more staff, mainly in the higher grades, were released on early severance or early retirement terms at the end of 1996/97. Approval has been given for a further 14 staff to leave on restructuring grounds between 31 March 1998 and 31 March 1999. A proportion of the savings from these latter cases will be returned to NERC, with the balance being retained in CEH to allow for appointments at a more junior level to improve the skill profiles.

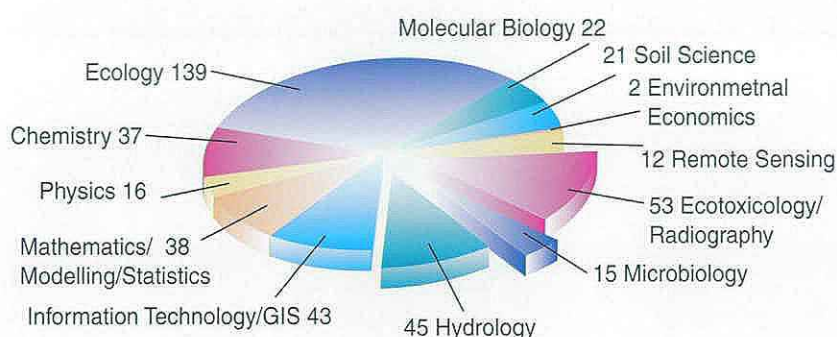


Figure 7. CEH Staff - Scientific Skills

Implementation of the NERC policy for the use of fixed term appointments (FTAs) for scientific staff in CEH, and transfers on to the permanent staff complement continues at a steady pace. Reviews have been taking place at regular intervals.

626 staff were in post in CEH on 31 March 1998, a net increase of 10 compared with 31 March 1997. Of these, 176 are on fixed term appointments. The figures for 31 March 1998 do, however, reflect the addition of 20 staff following the transfer of responsibility for computer support from NERC Scientific Services to CEH, and of 7 staff, formerly part of the Remote Sensing Applications Development Unit (RSADU), who joined CEH (ITE) in mid-1997. Taking these staff out of account, there has been a net reduction of 17 staff over the period to which the report relates.

Total staff numbers in the CEH central Directorate and each of the CEH institutes as at 31 March 1998 are contained in Appendix 2.

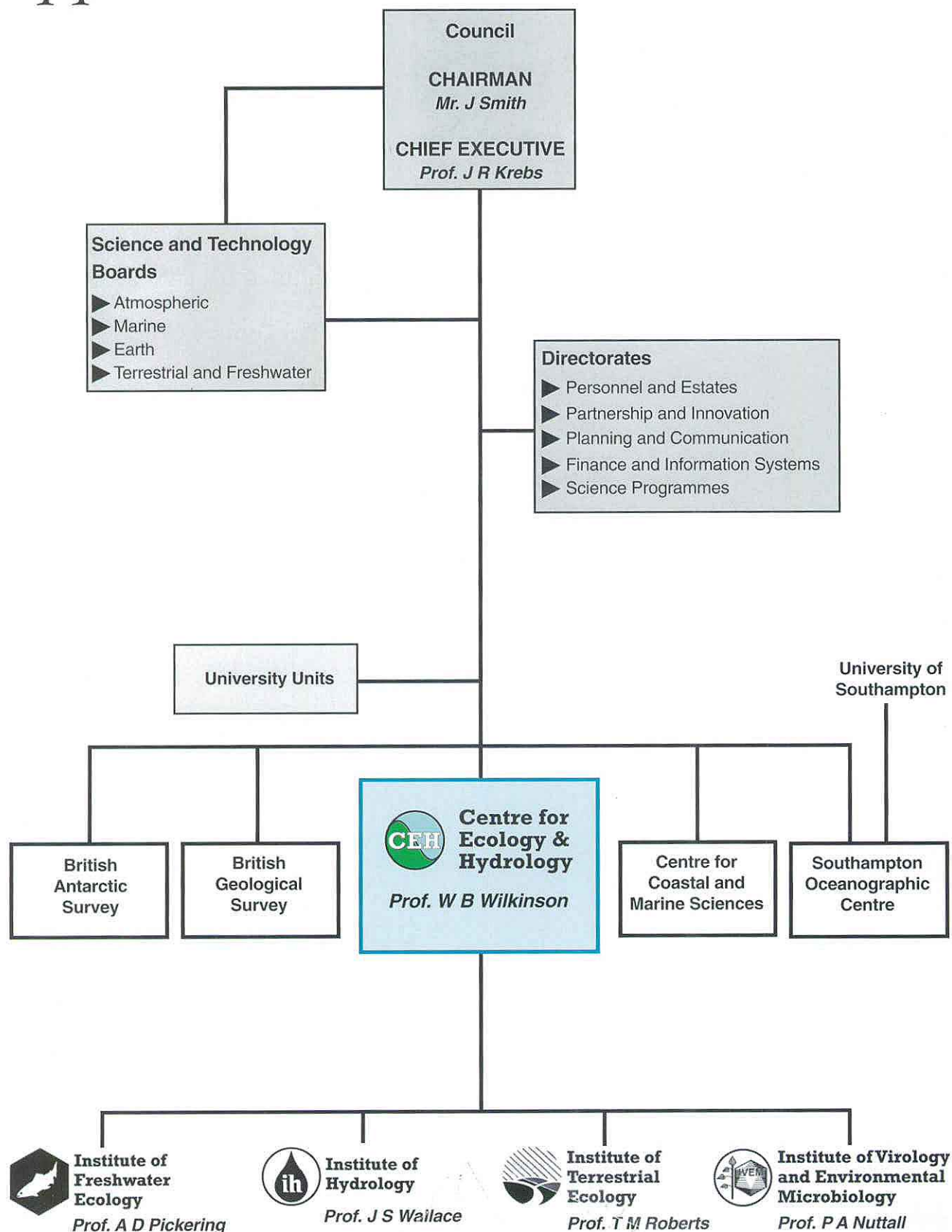


Appendices

- Appendix 1. NERC Structure**
- Appendix 2. CEH Organisation**
- Appendix 3. CEH Science Programme**
- Appendix 4. Major Sources of Income for CEH Institutes**
- Appendix 5. Membership of CEH Programme Review Groups**
- Appendix 6. CEH Representation on Key Committees**
- Appendix 7. CEH Advisory Committee**



Appendix 1: NERC Structure



Appendix 2: CEH Organisation

Director

Professor W B Wilkinson

Management Board

Professor W B Wilkinson, Director CEH
 Prof. T M Roberts, Deputy Director CEH and Director, Institute of Terrestrial Ecology
 Prof. A D Pickering, Director, Institute of Freshwater Ecology
 Prof. J S Wallace, Director, Institute of Hydrology
 Prof. P A Nuttall, Director, Institute of Virology & Environmental Microbiology
 Mr. P Williams, Head of Administration, CEH
 Dr. J C Metcalfe, Head of Science Policy (Secretary)

Total staff 626 (plus approximately 200 students and visiting scientists)



DIRECTORATE

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 Tel: 01491 838800
 Fax: 01491 692314

Director Prof. W B Wilkinson

Administration

Head of Administration
 Finance Officer/Deputy Head of Admin
 Contracts Officer
 Administration
 Director's Secretary

Mr. P Williams (based at NERC Swindon Office & Wallingford)
 Mrs. H M Wood
 Ms. L A Aspinall
 Mrs. A M Davies
 Mrs. K Vann

Science and Marketing

Science policy and co-ordination
 Marketing and science administration
 Publicity / Information Officer
 GCTE Project Office

Dr. J C Metcalfe
 Dr. W D Graham
 Mrs. E A Ginbey
 Mr. J I Ingram

Technical

Head of CEH Computing Services
 Safety Auditor

Mr. R Parsell (based at ITE Monks Wood)
 Mr. C Hankinson (based at ITE Merlewood)

Staff 34



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 Deputy Director Prof. J Hilton
 Acting Director FBA Prof. C S Reynolds

Head of Fish Biology Division
 Head of Microbial Ecology Division
 Head of Aquatic Processes Division
 Head of Ecosystem Management Division

Prof. J M Elliott
 Prof. B J Finlay
 Dr. E W Tipping
 Prof. J Hilton

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 Dr. A E Bailey-Watts

Staff 99.5



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Deputy Director **Mr. F M Law**

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Head of Water Quality Division
Head of Bio-physical Processes Division
Head of Risks and Resources Division

Mr. F M Law
Dr. A Jenkins
Dr. J H C Gash
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Prof. M Hornung

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Dr. S D Albon

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Prof. M G R Cannell

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Prof. J E G Good

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Deputy Director **Dr. E A Gould**

Staff 43.5

Appendix 3: CEH Science Programme

Soils and soil-vegetation interactions

Theme 1.1	Physicochemical processes affecting soil-water interactions
Issue 1.1.1	Solid-solution partitioning of chemical species
Issue 1.1.2	Organic matter decomposition and the production of humic substances
Issue 1.1.3	Mineral weathering
Issue 1.1.4	Integration of soil processes
Theme 1.2	Biologically mediated soil processes
Issue 1.2.1	Activity and diversity of key functional populations
Issue 1.2.2	Trophic interactions in soils and their influence on soil organic matter production and degradation
Issue 1.2.3	Manipulation of soil populations to improve soil quality
Theme 1.3	Physical and physiological processes controlling soil water balances
Issue 1.3.1	Soil-root interactions at the individual plant root and stand scale
Issue 1.3.2	Soil-plant-atmosphere flux transfers in mixed vegetation
Issue 1.3.3	Root-soil-water interactions adjacent to fluctuating water tables

Land use science

Theme 2.1	Long-term and large-scale monitoring of land use
Issue 2.1.1	National-scale survey of land use and cover
Issue 2.1.2	Remote sensing of land use and cover
Issue 2.1.3	Monitoring and evaluation of land use policies
Issue 2.1.4	International-scale land use survey and monitoring
Theme 2.2	Land use systems
Issue 2.2.1	Environmental impacts and management of farming systems
Issue 2.2.2	Environmental impacts and management of forestry systems
Issue 2.2.3	Impacts of land use (change and management)
Issue 2.2.4	Development of land use water resource management strategies
Issue 2.2.5	Environmental impact, coastal zone survey and management
Theme 2.3	Management of ecosystems in tropical regions
Issue 2.3.1	Management and restoration of forests and drylands
Issue 2.3.2	Agroforestry
Theme 2.4	Landscape function and modelling
Issue 2.4.1	Modelling spatial processes
Issue 2.4.2	Applied landscape ecology
Issue 2.4.3	Integrated modelling of land use processes including social and economic variables

The urban environment

Theme 3.1	Patterns of urban land/water use and associated habitats
Issue 3.1.1	Pattern and distribution of urban habitats in relation to past and present land/water use
Issue 3.1.2	Development of an index for urban soil 'health'
Issue 3.1.3	Biogeochemical survey of urban soils, sediments and waters
Issue 3.1.4	Physical properties of urban soils
Theme 3.2	Factors and processes determining the development of urban environments
Issue 3.2.1	Understanding soil processes
Issue 3.2.2	Urban impacts on hydrological processes
Issue 3.2.3	Aquatic ecosystem function
Issue 3.2.4	Terrestrial ecosystem function



Theme 3.3	The distribution and dynamics of atmospheric pollution
Issue 3.3.1	Measurement of transport, chemistry and deposition of gases/particles in urban environments
Issue 3.3.2	Reaction chemistry of primary pollutants close to source
Issue 3.3.3	Development of novel sensors for small-scale spatial heterogeneity
Issue 3.3.4	Measurement of direct effects of hydrocarbons on vegetation
Issue 3.3.5	Urban sources/sinks of radioactive pollutants
Theme 3.4	Urban water dynamics, risk and hazard
Issue 3.4.1	Low flows and pollution loads
Issue 3.4.2	Floods and pollution flushes
Issue 3.4.3	Surface-groundwater interactions
Issue 3.4.4	Risk and hazard
Theme 3.5	Sustainability, restoration and remediation of urban ecosystems
Issue 3.5.1	Collation of information on restoration and remediation requirements
Issue 3.5.2	Ecotypic selection and genetic engineering
Issue 3.5.3	Exploitation of soil processes
Issue 3.5.4	Sustainable water management

Freshwater resources

Theme 4.1	Surface-groundwater interactions
Issue 4.1.1	The recharge-runoff division
Issue 4.1.2	The river-aquifer boundary and floodplain issues
Issue 4.1.3	Wetland interactions
Issue 4.1.4	Integrated catchment scale analysis
Theme 4.2	Statistical modelling of resource availability
Issue 4.2.1	Estimation of resource availability at ungauged sites
Issue 4.2.2	Drought frequency estimation
Issue 4.2.3	Estimation of drought frequency from non-stationary data
Theme 4.3	Water resource modelling
Issue 4.3.1	Water resource management studies
Issue 4.3.2	Methodological developments
Issue 4.3.3	Risk analysis and decision support systems
Issue 4.3.4	Advances through special monitoring
Theme 4.4	Integrated water quality modelling
Issue 4.4.1	Monitoring and assessment
Issue 4.4.2	Understanding processes
Issue 4.4.3	Development and application of models
Issue 4.4.4	Management, planning and decision support
Theme 4.5	Integrated biotic response modelling
Issue 4.5.1	Flow resistance in channels and river ecosystems health
Issue 4.5.2	Integration of models of water quantity, quality and biotic variability
Issue 4.5.3	Improvement and diversification of biotic models
Issue 4.5.4	Biotic responses to long-term environmental change
Issue 4.5.5	Maintenance of knowledge base
Theme 4.6	Fish dynamics
Issue 4.6.1	Fish population dynamics
Issue 4.6.2	Acoustic deflection and counting of migratory smolts
Issue 4.6.3	Determination of habitat requirement
Issue 4.6.4	Physiological performance of freshwater fish
Issue 4.6.5	Models of growth and survival
Issue 4.6.6	Development of new technologies for assessing the growth performance of freshwater fish

Biodiversity and population processes

Theme 5.1	Biodiversity characterisation, pattern and monitoring
Issue 5.1.1	Species richness in relation to environmental factors
Issue 5.1.2	Biodiversity of communities and resilience to environmental change

Theme 5.2	Ecosystem function and biodiversity
Issue 5.2.1	Trophic interactions and ecosystem function: insect-plant interactions
Issue 5.2.2	Role of microbial diversity with respect to ecosystem function
Theme 5.3	Population processes underlying biodiversity
Issue 5.3.1	Organism responses, fitness and demographic functions
Issue 5.3.2	Interactions between demes, local populations and greater populations
Issue 5.3.3	Interactions between populations of different species
Issue 5.3.4	Comparative population and community processes
Theme 5.4	Conservation and restoration of biodiversity
Issue 5.4.1	Single-species conservation programmes: monitoring and evaluation
Issue 5.4.2	Ecology of introduced species
Issue 5.4.3	Habitat creation and restoration
Issue 5.4.4	Wetland management and restoration

Pest and disease control and risk assessment for GMOs

Theme 6.1	The development of sustainable insect pest management strategies
Issue 6.1.1	Population dynamics of pests of exotic plants in the UK
Issue 6.1.2	Use of plant resistance in pest management
Issue 6.1.3	Understanding the role of pathogens in insect population dynamics
Issue 6.1.4	Ecological impact of microbial control agents for disease vectors
Issue 6.1.5	Development of genetically modified bioinsecticides
Theme 6.2	Pathogen-derived genes for plant virus/vector management
Issue 6.2.1	Understanding the impact of plant viruses
Issue 6.2.2	Bacterial control of plant pathogens
Theme 6.3	Environmental impact of GMOs and potentially invasive species
Issue 6.3.1	Gene flow in natural plant populations
Issue 6.3.2	Environmental impact of genetically modified viruses and introduced pathogens
Issue 6.3.3	Development and risk assessment of genetically modified bacteria
Theme 6.4	Understanding and controlling arthropod-transmitted diseases
Issue 6.4.1	Vector-host interactions
Issue 6.4.2	Pathogen-host interactions
Issue 6.4.3	Pathogen-vector interactions
Issue 6.4.4	Pathogen-host-vector interactions
Theme 6.5	Distribution of pathogens in freshwater
Issue 6.5.1	Monitoring and risk assessment of pathogens in freshwater
Issue 6.5.2	Development of novel methods for detecting viruses in water
Issue 6.5.3	<i>Aeromonas salmonicida</i> : link between disease and life cycle strategy

Pollution

Theme 7.1	Radionuclides
Issue 7.1.1	Parameterisation of radionuclide contamination and transfer
Issue 7.1.2	Incorporation of spatial variability
Issue 7.1.3	Improving estimation of radiation doses
Issue 7.1.4	Development of countermeasures
Issue 7.1.5	Collaboration
Theme 7.2	Acidifying pollutants
Issue 7.2.1	Emissions
Issue 7.2.2	Atmospheric chemistry and transformations
Issue 7.2.3	Deposition
Issue 7.2.4	Impacts on soil-plant systems
Issue 7.2.5	Surface water and catchment-scale impacts
Issue 7.2.6	Modelling
Issue 7.2.7	Critical loads



Theme 7.3	Photochemical oxidants
Issue 7.3.1	Atmospheric transformations and transport
Issue 7.3.2	Emission, deposition and concentration fields
Issue 7.3.3	Impacts on vegetation, materials and human health
Theme 7.4	Toxic metals
Issue 7.4.1	Transport and deposition
Issue 7.4.2	Soil processes and soil-plant transfers
Issue 7.4.3	Transfer to animals
Issue 7.4.4	Ecotoxicology and environmental standards
Theme 7.5	Organic pollutants
Issue 7.5.1	Monitoring
Issue 7.5.2	Transport and food-chain transfer
Issue 7.5.3	Biological degradation and transformation
Issue 7.5.4	Physico-chemical processes controlling transport in soils and waters
Issue 7.5.5	Catchment-scale processes
Issue 7.5.6	Ecotoxicology and environmental standards

Environmental risks and extreme events

Theme 8.1	Risk assessment and estimation of floods and other extreme events
Issue 8.1.1	Mainstream research
Issue 8.1.2	Generic solutions to joint probability problem
Issue 8.1.3	Collective risk for environmental extremes
Issue 8.1.4	Continuous simulation modelling for flood estimation
Issue 8.1.5	Detection of trend and other non-stationary behaviour in time series of environmental extremes
Theme 8.2	Real-time flow and water quality forecasting and decision support systems
Issue 8.2.1	Methodological developments
Issue 8.2.2	Forecasting systems
Issue 8.2.3	Advances through special monitoring
Issue 8.2.4	Real-time water quality forecasting and decision support
Theme 8.3	Understanding and modelling the role of rare events on ecological systems
Issue 8.3.1	Rare events and ecological processes
Issue 8.3.2	Establishment of long term monitoring areas to study the impact of extreme events on ecosystems
Issue 8.3.3	The ecological repercussions of flood and droughts

Global change

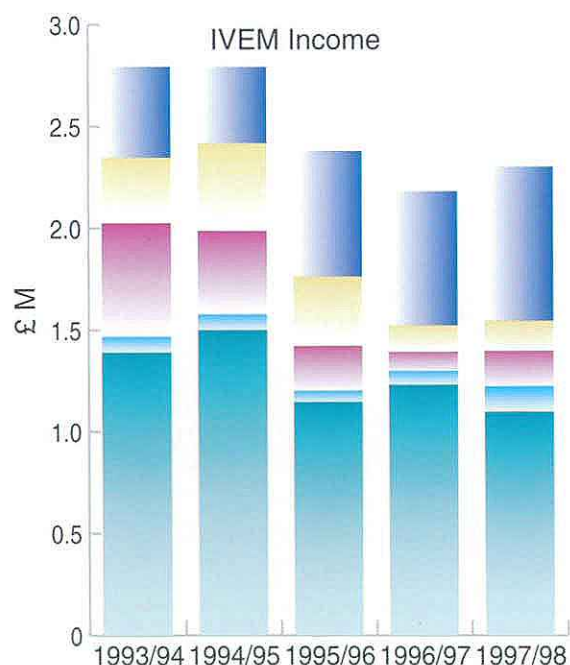
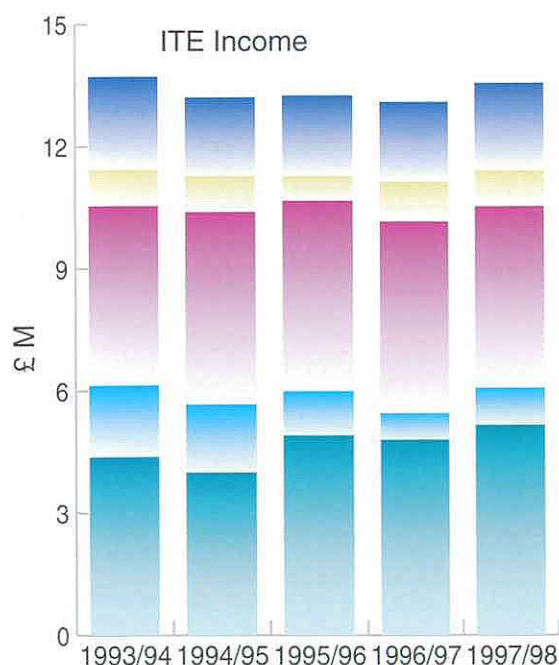
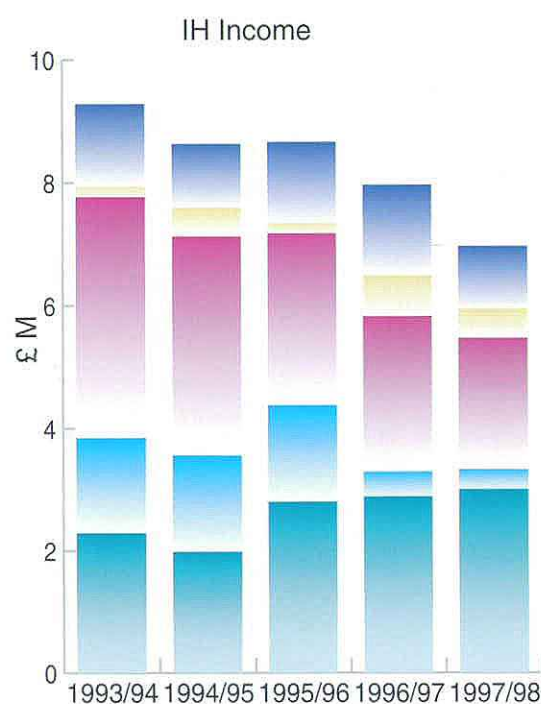
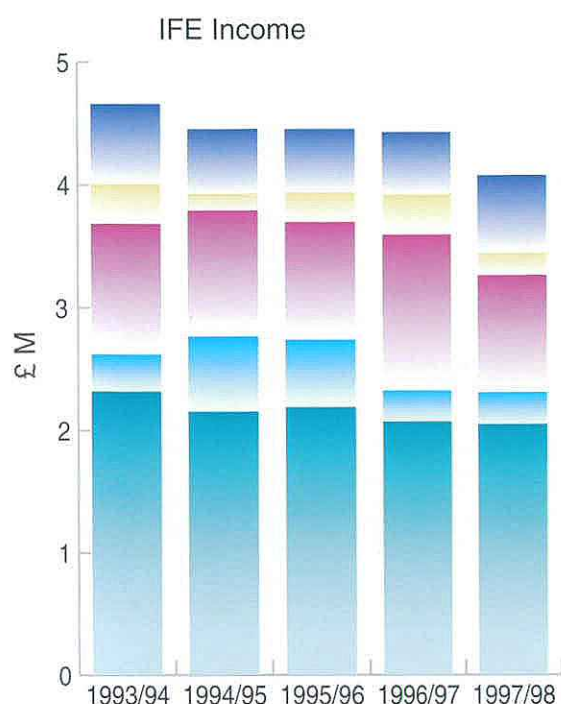
Theme 9.1	Greenhouse gas budgets and cycles
Issue 9.1.1	Global atmospheric CO ₂ monitoring
Issue 9.1.2	Controls of net CO ₂ and water/energy fluxes in Amazonia
Issue 9.1.3	Net CO ₂ fluxes for UK vegetation and soil
Issue 9.1.4	Exchange mechanisms in high-latitude wetlands
Issue 9.1.5	Greenhouse gas emissions for the whole UK
Issue 9.1.6	Atmospheric oxidation processes
Issue 9.1.7	Soil sinks of methane
Issue 9.1.8	Mid-latitude sources of N ₂ O and NO
Theme 9.2	Land-atmosphere-ocean interactions
Issue 9.2.1	Improved hydrological representations within GCMs
Issue 9.2.2	Land surface/climate interaction: tropical deforestation and desertification
Issue 9.2.3	Snow-melt and routing models for northern latitudes
Issue 9.2.4	Dynamic ecosystem models for GCMs
Theme 9.3	Forecasting and detecting the impacts of global change
Issue 9.3.1	Downscaling and predicting hydrological and water quality impacts
Issue 9.3.2	Impacts on the distribution, abundance and behaviour of species & communities
Issue 9.3.3	Impacts on the pools and fluxes of carbon nutrients in ecosystems
Issue 9.3.4	Using CEH databases to detect climate change impacts

Integrating generic science

Theme 10.1	Environmental assessment, economics and history
Issue 10.1.1	Environmental assessment
Issue 10.1.2	Environmental economics
Issue 10.1.3	Environmental history
Theme 10.2	Remote sensing
Issue 10.2.1	Development, calibration and validation of remote sensing systems and data products
Issue 10.2.2	Algorithms and models for estimation of biophysical variables
Issue 10.2.3	Use of remote sensing for distributed hydrological and ecosystem modelling
Issue 10.2.4	Generic data products from earth observation
Issue 10.2.5	Infrastructure and facilities
Theme 10.3	Instrumentation
Issue 10.3.1	Intelligent sensor clusters
Theme 10.4	Biotechnology development
Issue 10.4.1	Viral replication
Issue 10.4.2	Structure/function relationships of viral proteins
Issue 10.4.3	Molecular technology collaboration across CEH
Theme 10.5	Analytical chemistry
Issue 10.5.1	Application and development of analytical instrumentation for environmental research
Issue 10.5.2	Development and evaluation and standardisation of analytical methods in ecology
Issue 10.5.3	Characterisation and modelling of chemicals in environmental materials
Theme 10.6	Databases and reference collections
Issue 10.6.1	Integrity and accessibility of databases and collections within CEH
Issue 10.6.2	Monitoring environmental change
Issue 10.6.3	Environmental management
Issue 10.6.4	Microbial diversity
Theme 10.7	Biometrical applications, research and development
Issue 10.7.1	Biometrical collaboration
Issue 10.7.2	Application and development of biometrical methods
Issue 10.7.3	Statistical training



Appendix 4: Major Sources of Income for CEH Institutes



■ NERC
■ Thematic / Non-Thematic Programmes
■ Science Budget
■ EC
■ Other External Income
■ UK Government Customers

Appendix 5: Membership of CEH Programme Review Groups

Land and water resources

CEH Programmes

1. Soil & soil-vegetation interactions
2. Land use science
3. The urban environment
4. Freshwater resources

Prof. H S Wheater (Chair)

Dr. A M C Edwards
Prof. K Killham
Prof. R H Marrs
Dr. J Mulder
Prof. G E Petts

Engineering hydrology
Water quality
Soil microbiology
Land
Soil-water science
Land/river interactions, ecology

Imperial College London
Environment Agency, Leeds
University of Aberdeen
University of Liverpool
NISK, Norway
University of Birmingham

Biodiversity

CEH Programmes

5. Biodiversity
6. Pests and disease control

Prof. C C Payne (Chair)

Prof. V K Brown
Prof. C Gliddon
Prof. D A Ritchie
Prof. M B Usher
Prof. K Vickerman FRS

Virus biotechnology
Invertebrates
GMOs
Microbial genetics
Ecology
Zoology

Horticulture Research Int.
CABI Bioscience
University of Wales, Bangor
University of Liverpool
Scottish Natural Heritage
University of Glasgow

Pollution, risks and environmental change

CEH Programmes

7. Pollution
8. Environmental risks
9. Global change

Prof. J A Lee (Chair)

Dr. C W Anderson
Prof. C Cunnane
Prof. J Grace
Prof. C H Walker

Pollution
Statistics
Flood hydrology
Climate change
Ecotoxicology

University of Sheffield
University of Sheffield
University of Galway
University of Edinburgh
University of Reading

Monitoring, data, assessment, valuation

CEH Programme

10. Integrating generic science

Dr. J C Rodda (Chair)

Prof. T A Burke
Prof. P J Curran
Dr. R H Haines-Young
Mr. J Murliss
Prof. C Perring
Dr. P A S Rae

Hydrology
Genetic fingerprinting
Remote sensing
GIS
Atmospheric pollution
Environmental economics
Environmental planning

President of IAHS
University of Leicester
University of Southampton
University of Nottingham
University College London
University of York
British Gas



Appendix 6: CEH representation on key external scientific and decision-making committees

Committee

CEH Representatives

UK MAJOR LEARNED SOCIETIES

Botanical Society of the British Isles
 Botanical Society of the British Isles
 British Arachnological Society
 British Bryological Society
 British Ecological Society
 British Ecological Society
 British Ecological Society
 British Ecological Society, Symposia Editor
 British Ecological Society

- Council

- Meetings Committee

- Meetings Committee

- Publications Committee

Publications Committee

Strategic Plan Working Group

British Herpetological Society

British Hydrological Society

British Hydrological Society

British Mycology Society

British Ornithologists Union

BTO Science Advisory Committee

British Society for Soil Science

Executive Committee of the Tropical Agriculture Assoc

Fisheries Society of the British Isles

Institute of Biology Environment Committee

Institute of Biology

Royal Entomological Society

Royal Entomological Society

Royal Meteorological Society

Royal Society

- Sectional Committee 9

Royal Society for the Protection of Birds

- Council Member

- Conservation Committee

Royal Society of Edinburgh

Royal Society for Tropical Medicine & Hygiene

Society of General Microbiology

- Environmental Microbiology Group

- Virology Committee

Society for General Microbiology

Dr. C D Preston

Mrs. J Croft

Mr. R G Shazell

Prof. M O Hill

Dr. B A Emmett

Prof. A J Gray

Dr. J M Bullock

Prof. N R Webb

Vice President

Dr. S Hartley

Prof. N R Webb

Dr. S Hartley

Prof. S D Albon

Prof. A J Gray

Prof. A J Gray

Mr. H Arnold

Mr. F M Law

Mrs. C Kirby

Dr. J C Frankland

Prof. I Newton

Dr. L G Firbank

Prof. M Hornung

Mr. H M Gunston

Dr. I J Winfield

Prof. N R Webb

Dr. J D Goss-Custard

Dr. J A Thomas

Dr. A Watt

Prof. D Fowler

Prof. I Newton

Prof. I Newton

Prof. I Newton

Prof. I Newton

Prof. I Newton

Prof. M G R Cannell

Prof. P A Nuttall

Dr. E A Gould

Dr. M J Bailey

Dr. I M Jones

Prof. R D Possee

Chair

President

President Elect

Vice President

Fellow

Chairman

Chairman

Editor

Co-Ordinator

UK GOVERNMENT DEPARTMENT AND OTHER PUBLIC SECTOR

Advisory Committee for Genetic Modification

Advisory Committee for Hazardous Substances

Advisory Committee on Pesticides

Advisory Committee on Releases to the Environment

Advisory Committee on Toxic Substances

Atlas 2000 Steering Group

Atlas 2000 Steering Group

Biodiversity Action Plan - Field Margins Subgroup

BBSRC Microbial Genomics Working Party

BNSC Earth Observation Link Programme Management Committee

Climate Change Review Group

Critical Loads Advisory Group

Critical Loads Advisory Group

Prof. T M Roberts

Prof. T M Roberts

Prof. T M Roberts

Prof. A J Gray

Dr. S Dobson

Dr. C Preston

Mr. P T Harding

Dr. L G Firbank

Dr. M J Bailey

Dr. J Hinton

Prof. M G R Cannell

Prof. T W Ashenden

Prof. K R Bull

Critical Loads Advisory Group	Prof. D Fowler	
Critical Loads Advisory Group	Ms. J R Hall	
Critical Loads Advisory Group	Dr A Jenkins	
Critical Loads Advisory Group	Prof. M Hornung	
DETR		
- Biodiversity Action Plan Steering Groups	Dr M Marquiss	
- Biodiversity Information Group	Prof. T M Roberts	
- Biodiversity Steering Group	Prof. T M Roberts	
- Working Group on Birds of Prey	Prof. I Newton	
- Working Group on Endocrine Disruptors	Dr A S Dawson	
DETR Technical Committee on Detergents and the Environment	Dr W A House	
DETR AATSR Programme Steering Panel	Dr J Hinton	
DOH Review Panel for CAMR - Expert Adviser	Dr E A Gould	
DOH UKXIRA Advisory Panel (Xenotransplantation)	Dr E A Gould	
DTI/MAFF Horticulture Link Programme Management Committee	Dr J I Cooper	
DIID Environment Research Programme Science Committee	Prof. T M Roberts	
DTI Queens Award Panel 1	Prof. J Sheail	
Environment Agency		
Area Environment Group (Northern Area)	Prof. A D Pickering	
Client Board, National Centre for Environmental Data & Surveillance	Prof. B K Wyatt	
Regional Fisheries Advisory Council (NW Region)	Dr I J Winfield	
River Habitat Survey Technical Committee	Dr F H Dawson	
Toxic Algae Task Group	Prof. C S Reynolds	
EPSRC Waste & Pollutions Management Steering Committee	Dr D Osborn	
Food and Agricultural Countermeasures Group	Dr B J Howard	
Foresight DTI/OST Agriculture, Horticulture Forestry Panel	Dr J I Cooper	
HSE ACDP Committee	Dr E A Gould	
HSE ACGM Technical Committee	Dr J I Cooper	
Health & Safety Ad Hoc Working Group on Bats and Remedial Timber Treatment	Dr R F Shore	
House of Commons Committee on Usage of Sludge on the Land	Dr E A Gould	
Interdepartmental Committee for Hydrology	Mr. F M Law	Chair
JNCC International Designations Group	Mr. P T Harding	
JNCC Seabird Monitoring Committee	Dr S Wanless	
JNCC Seabird Monitoring Committee	Prof. M Harris	
JNCC Seabird 2000 Steering Committee	Dr S Wanless	
JNCC - Steering Group on Red Kite Reintroduction	Prof. I Newton	
LINK Programme Management Committee - Biological		
Treatment of Soil and Water (NERC)	Dr M J Bailey	
MAFF/HSE Advisory Committee on Pesticides	Dr S Dobson	
NERC EDGE Programme Steering Committee	Dr R S Hails	
NERC Terrestrial Sciences Research Grants and Training		
Awards Committee	Dr M J Bailey	
Radioactivity Research and Environment Monitoring Committee	Dr B J Howard	
UK Other		
AGI Environmental Interest Special Group	Mr. N J Brown	Chair
BSI Biological Methods Committee	Dr P D Amitage	
BSI Working Group on Soil Water	Mr. J D Cooper	
British Consultants Bureau - Water Engineering Committee	Mr. F A K Farquharson	
British Trust for Ornithology		
- Estuaries Advisory Panel	Dr J D Goss-Custard	
- Population & Surveys Committee	Prof. I Newton	
- Population Monitoring Advisory Panel	Dr J D Goss-Custard	
- Ringing Committee	Dr S Wanless	
- Science Advisory Committee	Dr L G Firbank	
- Unconventional Marking Panel	Prof. M P Harris	
Butterfly Conservation Society	Dr J A Thomas	Vice President
Butterfly Conservation Society	Mr. P T Harding	
Conservation Research Committee, Institute of Zoology	Dr J D Goss-Custard	
Environment Agency Regional Environment Protection Advisory Committee (Wales)	Prof. J E G Good	
Executive Committee, Linking Environment & Farming	Dr L G Firbank	
Field Studies Council	Prof. C S Reynolds	
Forestry Commission Regional Advisory Committee (Wales)	Prof. J E G Good	
Institute of Irrigation and Development Studies Advisory Board	Mr. H M Gunston	
Joint Committee for Conservation of British Invertebrates	Dr M Teller	
Joint Committee for Conservation of Large Blue	Dr J A Thomas	



Land Use Research Co-ordination Committee
 Monitoring Committee, Shetland Oil Terminal Environmental Assessment Group
 Moors River Standing Committee
 National Biodiversity Network
 National Biodiversity Network
 Natural History Museum - Advisory Board to the Identification
 Qualification (IdQ) Scheme
 OFWAT CSC for the North West
 Photochemical Oxidants Review Group
 Steering Committee, Centre for the Study of Environmental
 Change and Sustainability
 SCALE Aquaculture Project Advisory Committee
 SOTEAG Monitoring Committee
 Terrestrial Sciences Peer Review Committee
 Terrestrial Sciences Peer Review Committee
 Terrestrial and Freshwater Science and Technology Board
 UK Federation of Culture Collection
 UK Irrigation Association
 UK National Committee for Biodiversity
 UK Plant Genetic Resources Group
 UKNCC
 University of Reading Plant Sciences Advisory Board

EUROPEAN

EurAqua
 BIOTEX Subcommittee of Eurotrac
 Board of the European Forest Institute
 Council of Europe - Group of Experts on the Conservation of
 Invertebrates (Berne Convention)
 EC DG XII (Environment Space) Thematic Co-operation Group on Space
 Techniques in the Context of Major Hazards
 EC Science Directorate Training and Mobility Programme
 EC Science Directorate Training and Mobility Programme
 EC Standing Committee on Plant Health, invited expert/ consultant to
 Swedish National Chemicals Inspectorate
 EC Working Group on Ozone Strategy
 EEC Biostructure Groups
 EIFAC/ICES Working Group on Eels
 EIFAC Working Party on the Influence of Management Practices on the Environment
 EU Group of Experts on Demonstration in Life Sciences and
 Technologies, RTD IVth Framework Programme
 EU TMR DIAS Large Scale Facility Selection Panel
 European Committee of Chimeric Virus-like Particles
 European Conservation Research Institute Network (CONNECT)
 European Geophysical Society - Natural Hazards Section
 European Heathland Network
 European Invertebrate Survey
 European Topic Centre on Land Cover
 European Topic Centre for Nature Conservation
 International Cooperative Programme on Effects of Air Pollution and
 other Stresses on Crops and Non-Wood Plants
 OECD Consultant (UK) - Working Party on Biotechnology,
 Steering Group on Scientific Technology Infrastructure
 (Support for Biological Resource Centres)
 Seabird Group
 UNESCO International Hydrological Programme FRIEND - N Europe

INTERNATIONAL

Baikal International Centre for Ecological Research
 Convention on Long Range Transboundary Air Pollution (CLRTAP)
 - Executive Body
 - Task Force on Mapping
 - Working Group on Effects
 ESF Working Group on Long Term Research
 ESF Life and Environment Sciences Standing Committee
 European Heathland Network Convenor
 European Space Agency, ESA Specialists Panel

Dr L G Firbank
 Prof. M P Harns
 Dr J F Wright
 Prof. T M Roberts
 Mr. P T Harding

Dr J F Wright
 Prof. C S Reynolds
 Prof. D Fowler Chair

Prof. M G R Cannell
 Mr. G D Collett
 Dr S Wanless
 Prof. B K Wyatt
 Dr P Ineson
 Prof. W B Wilkinson
 Dr J G Day
 Dr R Ragab
 Mr. P T Harding
 Prof. A J Gray
 Dr J G Day
 Prof. A J Gray

Prof. W B Wilkinson UK leader
 Prof. D Fowler Chair
 Prof. M G R Cannell

Mr. P T Harding

Mr. D S Biggin
 Dr J I Cooper
 Prof. P A Nuttall

Dr M J Bailey
 Prof. K R Bull
 Dr I M Jones
 Dr D Carss
 Dr I J Winfield

Dr M J Bailey
 Dr S Plummer
 Prof. P Roy
 Prof. T M Roberts
 Mr. R J Moore
 Prof. N R Webb
 Mr. P T Harding
 Mr. R M Fuller
 Dr D Moss

Convenor

Dr G E Mills Chair

Dr M J Bailey
 Dr S Wanless Chair
 Dr A Gustard

Dr I J Winfield

Prof. K R Bull
 Prof. K R Bull Chair
 Ms. J R Hall
 Dr T Parr
 Prof. W B Wilkinson
 Prof. N R Webb
 Dr R Ragab

GTOS Steering Committee	Dr T Parr	
IAHS International Commission for Surface Water	Dr A Gustard	Vice President
IAHS Programme Committee for IUGG 1999 Conference	Prof. W B Wilkinson	
IAWQ UK National Committee	Dr A Jenkins	
IDNDR UK National Co-ordinating Committee	Dr A Gustard	
- Science Engineering and Technology Sub-Committee	Mr. F Farquharson	
IGBP, BAHC Committee	Dr J H C Gash	
IGBP, GCTE Focus 3 Committee	Dr J I Ingram	
IGBP-DIS Global Land Cover Working Group	Prof. B K Wyatt	
International Association of Landscape Ecology - UK Section	Dr R G H Bunce	
International Association for Vegetative Science	Prof. M O Hill	
International Commission on Irrigation and Drainage	Dr R Ragab	
IUCN Cormorant Specialist Group	Dr D Carss	UK Rep
IUCN/SSC Freshwater Fish Specialist Group	Dr I J Winfield	
IUCN/SSC Invasive Species Specialist Group	Dr I J Winfield	
IUCN Introductions Committee	Dr J A Thomas	
IUCN Invertebrate Conservation Task Force	Dr G W Elmes	
IUCN Social Insect Conservation Specialist Group	Dr G W Elmes	
IUCN Wetlands Programme Advisory Committee	Dr M C Acreman	
Intergovernmental Panel on Climate Change	Prof. M G R Cannell	
International Committee of 100 for the International Ornithological Congress	Prof. I Newton	
International Committee for the Taxonomy of Viruses	Prof. P A Nuttall	
- Advisory Panel	Dr E A Gould	
- Baculovirus Sub-Committee	Prof. R D Possee	
- Comoviridae Subgroup	Dr J I Cooper	
International Society for Avian Endocrinology - Scientific Committee	Dr A S Dawson	Chair
International Wildfowl Research Bureau - Waterfowl Ecology Working Group	Dr J D Goss-Custard	Co-ordinator
International Union of Forestry Research Organisations	Prof. M G R Cannell	
International Union of Radioecology	Dr B Howard	Hon. Treasurer
OECD Working Group on Avian Toxicity Testing	Dr S Dobson	
Programme Committee, Peregrine Fund, North America	Prof. I Newton	Chair
Raptor Research Foundation	Dr R E Kenward	
Society for Invertebrate Pathology	Dr J S Cory	Trustee IVEM
UNESCO MAB UK Committee	Prof. T M Roberts	Chair
UNESCO International Hydrological Programme - UK Committee	Mr. F M Law	Chair
UNESCO International Hydrological Programme Project 1, FRIEND		
UNESCO Natural and Social Sciences Commission	Dr A Gustard	Chair
WHO/FAO Joint Meeting on Pesticides - Core Assessment Group	Prof. W B Wilkinson	UK Leader
WHO Review Board for Concise International Chemical Assessment Documents	Dr S Dobson	Chair
WMO Commission for Hydrology	Dr S Dobson	
WMO Commission for Hydrology	Prof. W B Wilkinson	UK Leader
WMO Expert Group on reviewing trend detection methods	Mr. F M Law	
WMO GEWEX Canadian Advisory Panel	Dr A Robson	
WMO GEWEX Scientific Steering Group	Prof. W B Wilkinson	
WMO Global Runoff Data Centre Steering Committee	Prof. W B Wilkinson	
International Committee on Atmosphere-Soil-Vegetation Relations	Dr G Rees	
	Prof. J S Wallace	Vice President



Appendix 7: CEH Advisory Committee

An Advisory Committee has been established to advise Director CEH on short and long term scientific opportunities and priorities, the maintenance of science quality, and management policy. Members of the Committee are as follows:

The Earl of Cranbrook (Chair)

Professor W B Wilkinson Director CEH

Dr Alan Apling Head of Division, Science & Technical Policy Division, DETR

Professor Chris Arme Department of Biological Sciences, Keele University

Mr Andrew Bennett Chief Natural Resources Adviser, DFID

Dr Eileen Buttle

Dr Alan Cooper School of Environmental Studies, University of Ulster

Ms Julie Hill Programme Adviser, The Green Alliance

Dr Paul Leinster Director of Environmental Protection, EA

Dr David Parry Director of Power Technology, Powergen plc

Professor Chris Payne Chief Executive, Horticultural Research International

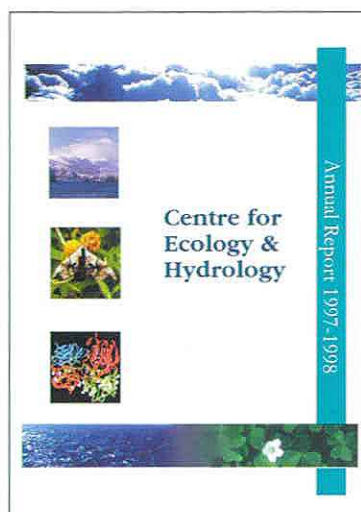
Dr Andrew Rushworth Head of Division, Scientific Research, Education & Advisory Services Division, SOAEFD

Professor Roger Williams Vice-Chancellor, University of Reading

Dr Jane Metcalfe Science & Policy Co-ordinator, CEH
(Secretary to the Committee)

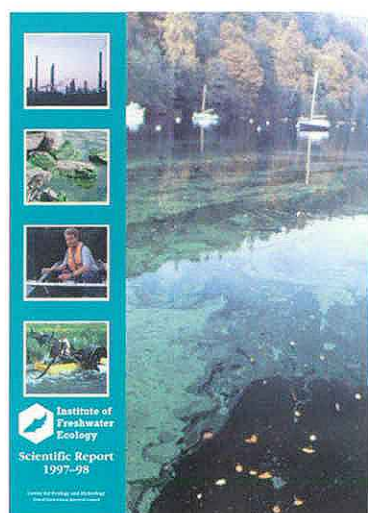
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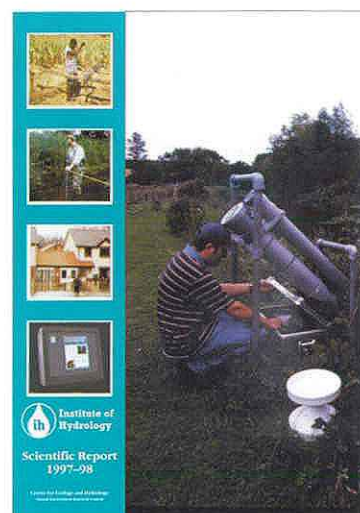
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Hydrology**

<http://www.ceh-nerc.ac.uk>



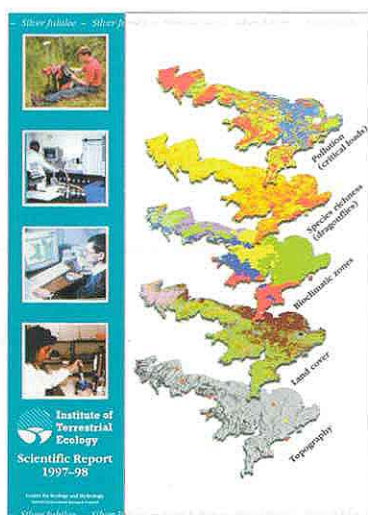
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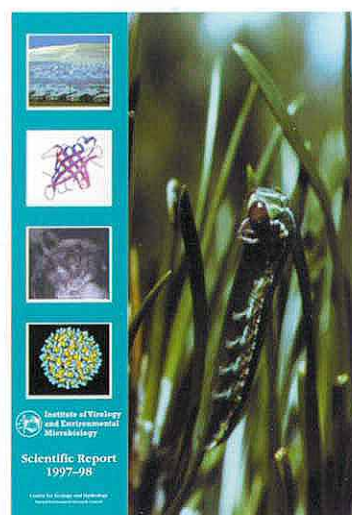
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**Institute of Virology
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Microbiology**

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