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FEATURE ARTICLES

Living in the greenhouse

How is the climate likely to change?

How significant will these changes be?

What adaptations can be made?

Much attention has been focused on how emissions of greenhouse gases can be reduced, to avoid 'dangerous' interference with the climate. However, at least some degree of climate change is inevitable, and little has been done to address this. Current scenarios of climate change in the UK suggest that its effects could be widespread, but to date, there has not been much attention given to what may need to be done to adapt to these changes.

This note is a summary of a longer report prepared by POST, which reviews the likely effects of climate change in the UK, and considers ways in which adaptations to change could be developed.

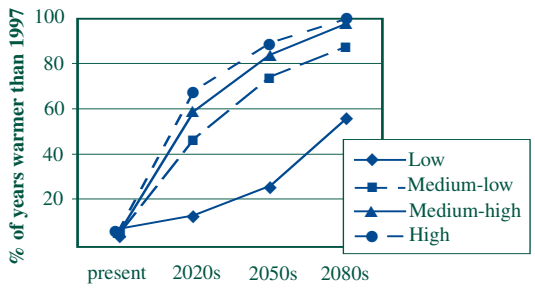
Things to come?

In 1996, the Government's Climate Change Impacts Review Group (CCIRG) published its review of the likely effects of climate change in the UK. This suggested that there would be noticeable changes. Key responses to these could include:

- coping with extreme weather-related events (such as storms, floods and landslides)
- managing agriculture to respond to changing conditions
- safeguarding public health against disease, heatstroke, food poisoning, etc.
- conserving water resources, especially in the south of England
- innovating in construction and urban design to minimise the effects of increased temperatures, higher wind speeds, flooding, etc.

More recent scenarios indicate that perhaps the most serious changes are likely to result from an increase in the frequency and magnitude of extreme weather related events, rather than smaller changes in average conditions. Because the predictions of climate change rely on computer models, combined with scenarios of possible future emissions of greenhouse gases, the scale, timing and location of these changes is uncertain. Also, the expected changes are not likely to be uniform across the country. Indeed, temperatures by the 2050s across southern England may increase by 0.9-2.6 degrees Celsius (deg C), while those in northern Scotland would rise by between 0.7 and 1.9 deg. C. Similarly, precipitation in the south will decrease, and increase in the north. An example of the effects expected under the most recent scenarios prepared for the Government sponsored UK Climate Impacts Programme (UKCIP) is shown in Figure 1.

Figure 1: Frequency of hot years in the UK



Source: Hadley Centre and Climatic Research Unit

IN THIS ISSUE

1997 was the third warmest year on record over the UK (1.1° C above the average between 1961 and 1990). On current records, a '1997 year' would be expected once every 17 years. Under the UKCIP scenarios (Low to High), by the 2080s, such years would occur with increased frequency. For instance, even under the Low scenario, these would occur every two years, and nearly every year for the other scenarios – so exceptional conditions are likely to become normal.

Responding to change

There are three ways in which humans can respond to climate change:

- Prevention (mitigation) to reduce or off-set emissions of greenhouse gases to prevent or delay the changes taking place, or to minimise them if they are to occur;
- Protection (adaptation) of human and natural systems to protect against the adverse effects and enhance the benefits of change;
- Acceptance of change and taking no action.

If the worst forecast effects of climate change actually occur, no society is likely to allow such impacts without some response, either by mitigation or adaptation. Uncertainties in climate modelling, impact assessment, cost-benefit analysis and the effectiveness of international efforts to curb emissions are so large that opting solely for the mitigation approach is not guaranteed to achieve success.

Thus, the Inter-governmental Panel on Climate Change (IPCC) regards it as prudent to develop responses to climate change based on both mitigation and adaptation.

IPCC has set out a seven-step guide to adaptation:

- define the objectives;
- specify important impacts;
- identify adaptation options;
- examine constraints;
- quantify measures and formulate alternative strategies;
- weigh objectives and evaluate tradeoffs;
- recommend adaptation options.

Again, because of the large uncertainties surrounding the possible scale, timing and extent of climate change, it is not currently possible to identify precisely what adaptations are necessary. However, as a starting point, the work of the UKCIP aims to provide integrated assessments of the effects of climate change, bringing together individual studies focused on individual sectors into a more holistic view. However, before deciding what adaptations are necessary and how to implement them, decisions are needed on whether adaptation is warranted in the first place. This will require a set of criteria against which the significance of the impacts can be judged. Only those exceeding the criteria will merit a response.

Possible ways of adapting to the six key effect areas listed above, are summarised in Box 1 opposite.

The overall effects of change

Assessments of the effects of climate change can take one of two forms:

- sectoral – where only the impacts on individual sectors (e.g. conservation, water resources, industry, insurance, forestry and agriculture) are assessed;
- integrated – where the cross-links between sectors are taken into account (e.g. the interactions between agriculture, water resources, biodiversity and flood and coastal defence).

In a sectoral assessment, the outcome will be a series of stand-alone statements of the effects, their significance, and any necessary adaptations. An integrated assessment, as well as statements of sectoral impacts, can consider the effects on the UK as a whole (or at least regionally).

However, while this sounds like an ideal outcome, it is not practicable to define an overall level of impact across so many diverse sectors – especially when there are likely to be both 'winners' and 'losers'.

This is a debate that has featured prominently for many years in developing methods for environmental assessment. Early attempts to define overall impacts were fraught with difficulty. These often involved spuriously precise and subjective judgments by analysts to quantify the magnitude and significance of impacts. These resulting scores were then combined to derive an overall impact 'grand' score – the plan or policy with the lowest 'grand' score being the one recommended for adoption. Such approaches soon lost credibility, so that methods became more descriptive, rather than numerical, with the overall assessment left very much to the political negotiations involved in making planning decisions.

The quest for a single measure of impacts has not faded, however, and a body of research into environmental economics has built up. Here, attempts are made to identify the monetary 'value' of many environmental and social 'assets', and then to combine these into traditional assessments of costs versus benefits. While progress has been made in some areas, many (including DETR) consider the approach as still in its infancy, and that the 'Holy Grail' of a fully operational environmental economics remains elusive. Similarly, many would prefer an approach based on quantitative risk assessments for assessing the significance of change. However, in its 21st report, the Royal Commission on Environmental Pollution (RCEP) says that 'no satisfactory way has been devised of measuring risk to the environment, even in principle, let alone defining what scale of risk should be regarded as tolerable.'

This view is reflected by the IPCC, which considers that a risk-based approach to dealing with climate change, involving attempts to place probabilities on the likelihood of different scenarios being realised, is flawed, and should not be pursued. Therefore, the lack of comprehensive rigour involved in environmental economics and risk assessment, taken together with the very large uncertainties surrounding the possible effects of climate change. suggest that making a simple statement of the overall significance of the impacts of climate change is not practicable at this time.

Strategies for adaptation

Developing a framework

Where adaptation is warranted, various issues arise:

- drivers of adaptation – the direction, extent or rate of change; and the relative importance of climate change compared with other social, economic and technological changes;
- the aims of adaptation – e.g. re-establishing circumstances to how they were before climate change; minimising harm; reducing vulnerability; enhancing resilience; or making changes that contribute to wider objectives such as 'sustainable development';
- location of the adaptation – e.g. global, regional, national, sub-national, local, or at the level of the individual enterprise;
- extent of the adaptation – e.g. although an effect may be large, it may not be significant, and only a minor 'tweaking' of current systems may be required;
- timing of adaptation – e.g. if the nature, scale and significance of impacts can be predicted reliably, it may be possible to anticipate the impacts and plan accordingly. Alternatively, adaptations may be possible as the changes occur;
- adaptation methods – e.g. whether adaptations to climate change will need to be planned, or will take place unconsciously (so-called 'autonomous' adaptation).

Climate change will not happen overnight, and will not result in a simple switch from current conditions to a new stable set of conditions. Climate change is anticipated to be a gradual and continual process that may last throughout the next century (and beyond). Consequently, adaptation will itself need to be continuous.

There are six strategies for coping with the negative effects of climate change:

- prevention of loss;
- tolerance of loss;
- spreading or sharing of loss;
- changing activities;
- changing location;
- restoration.

Similarly, there are a number of mechanisms for achieving these strategies (e.g. institutional, legal, regulatory, financial, structural, technological, research and education). A framework can be developed to examine each of the themes relating to climate change by examining systematically each of the strategies and how it could be effected, using each of the mechanisms.

BOX 1: Themes in adaptation to climate change

Coping with extremes

The most important impacts may result from increased magnitude and frequency of extreme events (such as high winds, heavy rainfall, flooding, and landslides). However, there has been no comprehensive assessment of changes in the likelihood of these events occurring in the UK. This is a very difficult and somewhat speculative area, because the large uncertainties in climate models mean that it is not possible currently to link any one event to climate change. Nevertheless, the insurance and construction industries have started to undertake research into aspects such as the postulated additional risks from flooding and subsidence.

Protecting natural areas

Climatic zones are likely to shift northwestwards by 50-80km per decade, so many species of plants and animals would have to migrate to remain in the conditions to which they are suited. Adaptive responses could include providing stepping stones and corridors of appropriate habitat along which mobile species could move. One difficulty is that the current nature conservation framework is based on maintaining specified sites as they are. Under the rapidly altering conditions that climate change might bring, a new approach to conservation would be needed.

Managing agriculture

Agriculture would also be affected by a north-westwards shift of climatic zones. Additionally, crop yields may be affected by 'fertilisation' by CO_2, longer-lived pests and diseases, and wetter winter conditions. Agriculture has been adapting to changes resulting from many factors other than climate change for many thousands of years. Changes in market conditions (particularly related to the Common Agricultural Policy) are the most important drivers, and larger impacts on this sector might result from such changes, rather than from climate change itself.

Safeguarding public health

Direct effects could include more heat-stroke and increases in vector and water-borne diseases, and in food poisoning. However, winter mortality due to cold is likely to decrease. There might also be indirect effects, such as stress resulting from flooding, or loss of life and property. Possible UK adaptations may involve managing sewage during extreme rainfall, managing wetlands to control mosquitoes that may carry malaria, improving ventilation in buildings and improving public education (e.g. relating to behaviour during heat-waves and food hygiene).

Conserving water resources

As rainfall patterns across the country change, the south is expected to become more deficient in water, but the effects on actual yields (the amount of water available for supply) are uncertain. Water resources are already under pressure (in the absence of noticeable climate change), due to demographic and lifestyle changes. Adaptations could include improving predictions of yields, controlling leaks, providing new supplies, and encouraging demand management (e.g. through the use of water-efficient appliances).

Innovating in construction and urban design

Effects here include those on people inside buildings, on the buildings and other constructions, and on the construction process. Adaptations include ensuring adequate ventilation and internal environmental conditions (e.g. more air-conditioning); strengthening buildings against higher winds and rain penetration; improving foundations against soil shrinkage and swelling; and managing construction during periods of high winds and rainfall. Fewer working days are likely to be lost as the result of extreme cold. Some adaptations are already being made, particularly in relation to Building Regulations dealing with foundations, ventilation and energy efficiency.

Research needs

To develop effective strategies, analysts, decision makers and stakeholders would need a considerable amount of information about the likely changes to the climate, their effects, their significance, the capacity to respond, and the cost-effectiveness of those responses. To date, however, this information is not available in most of the areas of concern, and so DETR is presently developing its ideas on how to address this research agenda. Studies are continuing into improving impact scenarios both locally and globally, to reduce uncertainties. Similarly, DETR is considering sponsoring a research project to review possible strategies for adaptation to the potential effects of climate change based on the UKCIP98 scenarios.

This project would provide an early overview of the key UK issues, were there to be a need to prepare for the effects of climate change. A further aim of the study could be to identify key gaps in information and deficiencies in methodologies. If this project goes ahead, one option might be for DETR to collaborate with other Government departments, agencies and the Research Councils to develop a coordinated programme of research into the objectives and methods of adaptation to climate change in the UK.

Furthermore, research is needed on broader areas of the climate change issue, including:

- international dimensions, such as how the UK would be affected by climate change elsewhere;
- improving understanding of natural processes (e.g. coastal and riverine processes);
- developing more 'holistic' assessment and management tools such as river catchment management and coastal zone management.

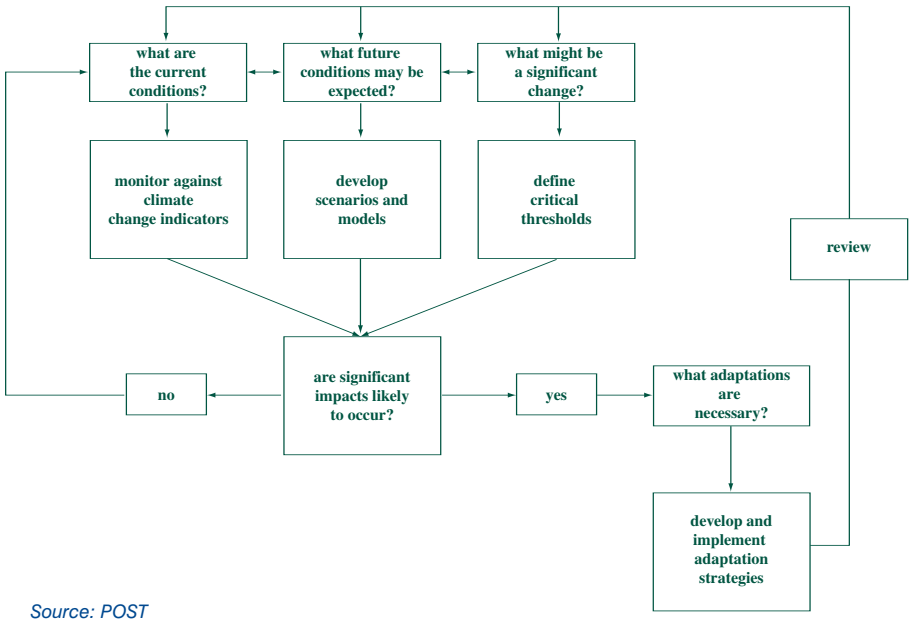
Implementing adaptation

As adaptation will need to be a continual process, a critical factor in ensuring that strategies are effective will be to build flexibility into decision-making. However, it is also necessary to recognise the many uncertainties involved. One way of approaching this could be to introduce a series of measures that would achieve more than one objective at once. These could correct existing 'anomalies' in economic systems or improve current systems and methods for tackling existing environmental or other problems, while at the same providing some capacity for adaptation within the current limits of uncertainty. Such measures might include:

- improving extreme weather predictions, warnings and emergency response systems;
- accommodating change on sites of nature conservation value;
- making agriculture more responsive to environmental pressures;
- improving the energy efficiency of buildings (e.g. using passive heating and ventilation);
- controlling land use to reduce or avoid risks (e.g. restricting flood-plain development).

The science of climate change continues to develop, but at present it is not advanced sufficiently to enable accurate predictions of the likely effects in the UK, so it is not currently possible to define detailed strategies for adaptation. One approach would be to develop a series of measures, that help to correct current inefficiencies unrelated to climate change but which simultaneously introduce some capacity to adapt to it at a later stage. This could be complemented by improved climate change predictions, integrated assessments of the effects, and the development of a 'route map for adaptation' based on continuous monitoring of climate change indicators, compared against criteria to assess the significance of impacts (Figure 2).

Figure 2: Climate change adaptation 'route map'



Source: POST

In conclusion

Although little work has been carried out in the UK on adaptation, the Government is beginning to address the issues. A number of areas for debate remain:

- whether the overall change will be good or bad;
- identification of 'significant' changes;
- whether there is an actual need for adaptation;
- if so, the effects that the adaptation seeks to address, and its aims, timing and methods;
- any necessary research requirements.
- *The full report of which this is a summary is available from the Parliamentary Bookshop (tel: 0171 219 3890), price £12.*

The funding of basic science: 'Big Science'

Professor Sir Peter Williams CBE
Chairman, Particle Physics and Astronomy Research Council

I start with two assertions: that scientific research is a legitimate, culturally enriching activity within any modern, advanced society and that perhaps more importantly, this activity underpins a great proportion of our economic well-being.

While 1 hope that these sentiments will find broad acceptance within a gathering such as this one, I nevertheless realise that it is incumbent on those of us within the scientific community to demonstrate their reality to the rest of society.

My role in this debate is to set the scene regarding what we have come to know as 'Big Science' – the major fields of research in the worlds of high energy physics and astronomy which today are characterised by the need for large, multinationally sponsored facilities. But I speak as an individual with a much broader interest in the future of science as a whole and I therefore hope that as the debate unfolds we will resist the temptation to tension big against what we must presumably call 'small' science – I certainly feel the latter term does little justice to the exciting work which Ray Baker will shortly be telling us about. So let us focus on the central role, as 1 see it, of science as a whole and discuss first the funding requirements as such.

Of course, since the White Paper of 1993, the structure of Government funded research in the UK has reflected such convenient shorthand and the Particle Physics and Astronomy Research Council, which I chair, is responsible for the funding of all UK high energy physics and astronomy research. The figures are, I believe, well known to all of you: within a science vote of some £1.3 billion, almost exactly £200 million is allocated to PPARC.

Regarding the Science Vote as a whole, one or two obvious questions immediately present themselves. First of all, it has been argued recently that Government should have no role at all in the funding of such basic research. Charities, wealthy foundations and, presumably, enlightened individuals should step into the breach. Frankly, given the competitive pressures of our modern world and the predilection of all major Governments to fund basic research at levels usually higher than that in the UK, 1 can see no merit whatsoever in such arguments. I commend to you the Government's annual SET statistics with their international comparisons, which I feel clearly demonstrate this.

The second question, however, if we accept the premise that Government involvement in basic research is both inevitable and desirable, is one of quantity. Leaving aside the considerable expenditure on research by the MOD, is £1.3 billion an appropriate sum for a modern nation such as ourselves? As a proportion of GDP this 'science vote' has fallen by almost 10 per cent since 1971 and taken together with the financial pressures on the UK's universities, there can be little doubt that this country will struggle under present funding regimes to maintain its position as a world power in the various fields of science in which we currently excel.

This is of course a very difficult assertion to prove objectively. However, what can, I feel, be stated with considerably greater confidence is that the effects at the margin of comparatively small increases in investment in basic research will have a disproportionately positive benefit. The Government's Comprehensive Spending Review offers the opportunity to redress the decline in basic science funding at only modest cost to the taxpayer.

But back to 'Big Science'. Let me turn first to what is surely the oldest branch of science known to man – astronomy. The statistics are straightforward. Almost £60 million of PPARC's budget is spent on the support of programmes in astronomy, with a further £40 million spent on our subscription to ESA, the European Space Agency. I will return later to the questions posed by our involvement in such international agencies.

How do we value the output from all this? I would first cite my opening premise that the study of our universe and its origins is an advanced expression of mankind's curiosity and a legitimate activity in which to engage for its own sake. Just look at the impact on the general public of the front page reports of the 'wrinkles in time' in the 'Big Bang' microwave background, or the immediate response to the beauty of the images of star formation captured by the Hubble telescope. Also, we should remember an important consequence of these attempts to broaden the public understanding and awareness of science: the effect on the young. A major factor which often attracts them into certainly the physical sciences is a fascination with astronomy. This helps, of course, to bring young people into 'Big Science' and graduates from our PhD programmes are sought after for their numeracy and team-working skills. But of much more general importance, today's budding astronomer, drawn into science at 'A' level, may well become tomorrow's software engineer.

Turning now to Particle Physics, a branch of science often thought of as considerably more impenetrable, these linkages with activities throughout society as a whole become even more apparent. But first, as with astronomy, a few comments on what I see as the fundamental drive behind our quest to understand our universe. Most people are at least familiar with the concept of the origin of our universe in a 'Big Bang', perhaps some 15 billion years ago.

What may be less apparent is the 'pincer move-

ment' which particle physics and astronomy together apply to our understanding.

Seeking ever higher energies at which to probe the structure of matter, particle physics moves close in time to the point of origin of the universe while astronomy, it may be thought, looks at the universe as it is today. But the recent images from the so called 'deep field' camera on the Hubble Telescope are in fact from galaxies forming at a time when the universe was barely one tenth of its present age. Put another way, the light which forms these images has been on its way to us for more than 10 billion years! Can we really say at the dawn of the next Millennium that mankind will put aside this quest and leave undiscovered the answers to questions such as the origin of mass? Surely unthinkable.

Where the two branches of science for which PPARC is responsible do divide is in their method. Astronomy is of course an observational science – as is geology, for example. Particle physics, on the other hand, is a classic experimental science – construct a hypothesis, devise a test and conduct an experiment. It is just that the experiments now entail an international effort involving thousands of scientists and billions of dollars.

Recognising this many years ago, the international community in particle physics has increasingly moved towards the pooling of resources into multinational programmes. Europe leads the world in both this more efficient utilisation of resource and in the scientific insights which result, largely as a result of the creation of CERN in Geneva. Time precludes my doing justice to this remarkable institution, though one or two immediate questions do arise which I will note before moving on to consider the technology of this branch of science.

First, the sheer scale of such 'big science'. The new Large Hadron Collider or LHC will cost in the region of 3 billion Swiss francs, or just over £1 billion. Expensive, yes, but shared between 19 advanced nations over a period of many years, surely affordable? The human genome project is of course aimed at much more immediately relevant scientific knowledge, but it is scarcely less expensive.

Secondly, the effect on PPARC's budget of what the Americans refer to as 'granularity'. Managing a £200 million allocation when over half of this sum is committed in advance to just two international subscriptions for CERN and ESA represents a considerable challenge. Add the vagaries of the international currency markets and the problems magnify. Yet the international treaties which bind us to both organisations involve many different agencies of Government and not just PPARC. It is therefore not simply a case of special pleading to argue that this factor be taken into account when looking at the future of 'Big Science'.

It is time to look briefly at the second of my premises – that basic research underpins much of our economic activity. In the physical sciences, as elsewhere, serendipity often takes a hand and I will in no way seek to justify the expenditure on 'Big Science' on the basis of some linear model of spin out and exploitation. But let us look at the development of applied superconductivity. Discovered in 1911, until usable 'engineering' materials emerged in the 1950s, the field of study remained a backwater in physics. However, the realisation that exceptionally high current cables could in turn offer the prospect of high magnetic fields immediately attracted the interest of the particle physics community in the 1960s and 1970s.

All the early drive to master the technology of superconductivity came from this group of physicists. Industrial spin offs were not far behind in the imagination of many. Levitated trains running on friction free magnetic cushions, loss free power transmission and electrical machinery and other attractive prospects seemed just around the corner. The reality in the late 1990s? The major industrial application of superconductivity is in the production of magnets for Magnetic Resonance Imaging body scanners, or MRI, a major industry worth almost $5 billion per annum world wide with incalculable benefits to mankind. Moreover, with technology at its heart in the form of the superconducting wires still often referred to as 'Rutherford Cable' after the high energy physics laboratory in the UK where so much of the early pioneering work was carried out. Serendipity indeed.

The story does not end there. The World Wide Web was invented at CERN to enable particle physicists to communicate their findings internationally. What price today this breakthrough? Accelerators of a much smaller kind, but owing their origins to the experimental work done by particle physicists, are to be found in hospitals and food processing. Larger systems, abandoned in the 1970s by the particle physicists for larger and more energetic machines, offered researchers of all disciplines the insights provided by synchrotron radiation. Specialist machines of this sort have now become 'Big Science' in their own right with costs of up to $1 billion, for example at Spring 8 in Japan. But where would biochemistry be today without synchrotron radiation based protein crystallography? Synchrotrons may yet even find their way into the manufacture of semiconductor chips.

Let me conclude by returning to my twin original assumptions. I have clearly demonstrated some of the spin outs and benefits which have accrued to us in a general sense from our involvement with 'Big Science'. It is of course difficult to put a cash figure on this and even more challenging to assess the earnings potential from future research investment. That will in great part be determined by the willingness of British industry with its £9 billion annual R&D spend to embrace any opportunities which arise. Finally, it is also difficult to compute the benefits to society in an intangible sense of the enhancement of our understanding of our universe. But surely, in a civilised world, such knowledge is indeed priceless?

■ *Summary of an address to the Parliamentary and Scientific Committee in June 1998. This article is reprinted with the kind permission of the publishers of Science in Parliament.*

This section of the Journal is in response to the growth of news, information and activities which underpin the Education Committee of the IES.

Special prominence is given to student activities and projects, national and international initiatives, campus developments and research in order to capture the diversity, wealth and vitality of modern environmental education.

Readers are invited to send articles and letters to:
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Towards a European network of environmental sciences

Introduction

The diversity and differing status of Environmental Science education in Universities across Europe has long been recognised. Lars Emmelin, the Swedish environmentalist, was one of the first to describe the patterns and nature of degree programmes across European countries and to identify features which characterised disciplinary, inter-, multi-, pluri- and trans-disciplinary modes of curricula in an OECD Report in 1973.

Twenty years later the First AuDes (Association of University Departments of Environmental Sciences in Europe) Conference in Zandvoort, the Netherlands in 1993 confirmed the existence of significant intra European variations in the availability of, and the conditions for, advanced environmental education at under- and post-graduate levels. Some basic and general trends noted then were that:

- universities in Europe were all providing considerably more environmental education than in 1973;
- there had been much more development of courses in North and West Europe than in South and East but there was significant progress in the latter;
- graduate environmental education was tied closely to the national environmental labour markets;
- there was need to clarify the essential core of the education and training of environmental professionals;
- improved exchange of existing practices in environmental education was desirable.

Trends across Europe

Today, virtually all higher education institutions in Europe offer one or more courses in Environmental Sciences at graduate or post graduate levels. Some of these are discipline oriented, eg, environmental chemistry, environmental engineering, and environmental economics. Others are problem oriented: eg, Integrated Water Management, Waste Minimisation and Recycling, Biodiversity and Environmental Quality, and Sustainable Development.

The proliferation, duplication and confusion in the market place about environmental education as noted for the UK in the Toyne Report occurs across other European countries. The problem reflects the more prominent position of environmental issues in the socioeconomic and political agenda of the EU and its member states in the last 20 years. Universities responded by founding environmental departments and establishing undergraduate and graduate degree programmes. Different models of environmental science/studies developed in relation to existing cognate disciplines ranging from natural to social sciences and multi and inter-disciplinary modes.

Due to historical, socio-economic, geographical and political circumstances nations and their higher education institutions naturally perceived different environmental needs and priorities. In addition to the heterogeneity and former piecemeal expansion of university environmental education, a further trend is emerging at the end of this millennium, at least in North and West European universities: the relative decline in the popularity of interdisciplinary environmental education and the swing back, supported by national government policies, to traditional disciplines. Utrecht University provides an example of some of the recent European wide trends and features of environmental science.

Utrecht University – a Dutch example

One of the top state universities in the Netherlands, Utrecht created a Department of Environmental Studies in 1988 in response to national and global environmental issues. It developed a course which was structured like many UK interdisciplinary environmental courses to try to integrate the natural and social sciences around the environmental agenda. Dr Paul Schot, the Course Director, believes such aims and philosophy provide 'training in multi and inter-disciplinarity' and the students produced can be described as 'broadened specialists', possessing a firm background in their own discipline but the ability to communicate with other related disciplines. The structure created to achieve this educational aim has evolved due to a number of internal and external factors (see table). In 1999, integrative courses are given in Environmental Science, European Fieldwork and multidisciplinary courses over the four year programme supplemented by more specialist courses. In the first year these are chosen from 11 basic natural sciences (beta courses) and social environmental sciences (gamma courses). Beta course include biology, chemistry and geology whilst gamma courses include law, human geography, planning. All students must undertake options from each category. In Year 2 students undertake two 'themes' emanating from their first year courses, one, Land Use and Environmental Quality which builds out from the Beta tradition, the other, Sustainable Production and

Introduction: Env Science + Policy	
Natural Environmental Sciences	**Social Environmental Sciences**
■ compulsory courses	■ compulsory courses
Excursion (Europe)	
Introduction central themes	
Theme 1: Land use and environmental quality	
Theme 2: Sustainable production and consumption	
Multidisc Exercise	
Specialisation Theme 1	**Specialisation Theme 2**
■ compulsory courses	■ compulsory courses
■ optional courses	■ optional courses
Multidisc Exercise	
Thesis	

Consumption from the Gamma tradition. In Year 3, there are two Specialisation Themes from which compulsory and optional courses are offered. Finally, there is a thesis.

This structure and composition will be familiar to many environmental educationalists in the UK. Interestingly, pressure to change in Utrecht came from students (whose numbers have declined from a peak of 90 in 1991 to about 30 in 1999, from the employers who wanted a more specialised product, and from the Ministry of Education who wanted a move back towards basic disciplines. So, across Europe practitioners of environmental education are experiencing some similar problems and trends.

ESSENCE

Now, a network has been established to address this agenda and to promote structural and fundamental collaboration amongst university (post)graduate environmental studies/science departments. Funded under Socrates, its aims ambitiously are to encourage structural educational collaboration and exchange across Europe in the area of (post) graduate environmental science/studies course. Given the acronym ESSENCE (Environmental Sciences Strengthened in Europe by Education, Networking and Conferences) the Dutch are taking a lead role in its Europe-wide coordination using the Association of Universities in the Netherlands (VSNU) and the AuDes Committee as central administrative resources,

In January 1999 they convened a weekend workshop in the Netherlands to begin to operationalise the ESSENCE agenda. A network of national coordinators has been established who by August 1999 have produced an overview of supply and demand of environmental science in their country, along with appropriate examples of environmental science courses.

It is hoped that this stage of ESSENCE will provide a national baseline comparison of the national context of environmental education, systems of HE, examples of different models of environmental degrees and relevant labour market statistics and features, relating to the member countries.

In the second year of ESSENCE, an analysis of the problems and issues will be undertaken from which specific projects and detailed tasks will be identified.

A very ambitious concept!

Further information

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ESSENCE network, Association of Universities in the Netherlands (VSNU), PO Box 19270, NL-3501 DG Utrecht
5th AuDes Conference on Environmental Education, Case Studies in Environmental Education and Research, Zurich April 15-17 1999, UNS Umweltnatur-und-Umweltsozialwissenschaften, ETH Zentrum, Had CH -8092, Zurich
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ENVIRONMENTAL NEWS

National air quality strategy

The National Air Quality Strategy was published by the previous administration in March 1997 fulfilling the requirement under the Environment Act 1995 for a national air quality strategy setting out policies for the management of ambient air quality. The Government endorsed this strategy in July 1997, but announced that it would be reviewed at the earliest opportunity in order to look at the prospects for delivering cleaner air more quickly. In announcing its conclusions from the review, the Government has been able to make rapid progress on delivering on its commitment to the right to clean air.

The strategy sets objectives for 2005 for the eight air pollutants which have the greatest impact on health. The aim of the review has been to look at the prospects for meeting the objectives sooner or introducing tougher health-based objectives where feasible and justified. The review has been wide-ranging, covering the legal framework, the scientific, economic and technical basis for decision-making on air quality policy and the case for changes to the scope and content of the strategy. DETR has worked closely with other Government departments and has consulted widely with stakeholders in producing the proposals.

The detailed outcome of the review for each of the eight pollutants is:

For **benzene, 1.3-butadiene** and **carbon monoxide** the date for achieving the objectives is to be brought forward from 2005 to 2003. A new tougher indicative level will also be set for benzene.

For **lead** the date for achieving the objective is to be brought forward from 2005 to 2004, and a new tougher objective will be set for 2008.

For **nitrogen dioxide** the annual objective is not to be changed, but the hourly objective will be tightened. Present evidence suggests that the annual objective will be very challenging, in particular in London. These will be looked at again in two years' time when more information is available. A new objective for the protection of vegetation is introduced for 2000.

For **ozone** and **sulphur dioxide** the objectives will remain unchanged. For sulphur dioxide, a new objective for ecosystems is introduced for 2000.

For particles (PM_{10}) the present objective is to be retained as an indica-

tive level. The more relaxed limit values in the Air Quality Daughter Directive are to be introduced as objectives for 2004. The original objective was set on the basis of the limited knowledge at the time and it is now clear from our better understanding of the sources and types of particles that it will not be achievable by national measures alone.

Transboundary pollution from Europe accounts for a significant proportion of annual mean concentrations of PN_{10} and so is outside our control. Concerted action is needed at the European level to reduce particles, an issue which is to be pursued with other member states. Scientific evidence is moving forward rapidly in this area. The health evidence is pointing increasingly to the smaller fraction of particles ($PM_{2.5}$) as the most likely source of health effects. New scientific and medical evidence is expected to become available during the next year or so on the importance of $PM_{2.5}$, which will need to be considered with a view to setting a new objective for this smaller fraction of particles.

Benzene and 1.3-butadiene are genotoxic carcinogens for which no absolutely safe level can be defined. Carbon monoxide reduces the capacity of the blood to carry oxygen and deliver it to the tissues and can block important biochemical reactions in cells. High levels of lead can result in toxic biochemic effects in humans, but the possible effect on brain development of children is the greatest cause for concern. Nitrogen dioxide is thought to have both acute and chronic effects on airways and lung function, particularly in people with asthma. Exposure to ozone may cause irritation to the eyes and nose and very high levels can cause damage to the airway lining. Particulate air pollution episodes are responsible for causing excess deaths among those with pre-existing lung and heart disease. Sulphur dioxide affects the lining of the nose, throat and airways of the lung, in particular, among those who suffer from asthma and chronic lung disease.

Regularly updated information on air quality is available on Ceefax 410-417 and Teletext 106. The strategy is on the DETR air quality internet website: http://www.detr.gov.uk/airq/aqinfo.htm. Further copies of the NAQS consultation paper are also available from the DETR Free Literature, PO Box 236, Wetherby S3 7NB, telephone: 0870 1226 236, fax: 0870 1226237.

Airborne pollutants crossing frontiers

Airborne particles are pollutants which respect no international boundaries, confirms a new report published in January. The problem cannot be solved by the UK on its own and action will continue to be taken at European level.

Launching the report, *Source apportionment of airborne particulate matter in the United Kingdom,* Environment Minister Michael Meacher said:

'I welcome this report. I am very grateful for the panel's excellent work which provides us with the best possible advice on particles in the UK's air, where they come from, and what levels we are breathing, now, in 2005 and beyond.'

The report was prepared by the Airborne Particles Expert Group, chaired by Professor Roy Harrison of the University of Birmingham. The Expert Group has reviewed current knowledge on the levels and sources of particles in the UK, the physical and chemical characteristics of particles, and the long range transport capabilities of particles. The report shows that exceedences of our national health-based particle objective are strongly influenced by sources from continental Europe.

Michael Meacher said: 'Levels of airborne particles are decreasing – but not fast enough. The report has shown that this is not a problem the UK can solve on its own. The work of the Expert Group means that the UK is well ahead of the game in understanding this complex issue. We now intend to discuss with our European partners how best this issue can be taken forward, Europe-wide.'

Ministers and officials will be raising the findings of the Group and pressing for concerted EU action at the forthcoming Environment Council and at forthcoming European conferences.

The main findings of the new report are that:

- The main sources of particulate matter in the UK are 'primary' particles emitted directly from vehicle exhausts (and in some areas coal burning and industry); 'secondary' particles (formed by chemical reactions of gases in the air to form particles) mainly from long range transport from Europe and UK power stations; and 'coarse' particles comprised mainly of suspended soils and dusts, together wIth some sea salt, biological particles and particles from construction work.
- The existing, air quality standard for particles (PM_{10}) within the National Air Quality Strategy (50 ug/m^3 as a 24 hour running mean, to be achieved by the year 2005, four days exceedence allowed) will not be achieved with existing policies.
- Bonfire night activities alone will in some years bring PM_{10} concentrations close to exceeding the existing Strategy objective.
- National modelling, at urban background sites, based on current policies (excluding the Impact of bonfire night or similar festivals) showed widespread exceedence of the existing national particle objective. Exceedences are worst in years characterised by frequent air movements from Europe. Such meteorology can be expected to occur once every five to ten years.
- PM_{10} concentrations in the vicinity of busy roads are higher than those at background locations. Local industrial sources can also impact substantially on PM_{10} concentrations in some areas, as can domestic coal burning where this still takes place.
- National Inventories of primary emissions of fine particles ($PM_{2.5}$ and PM_1) and ultra fine particles ($PM_{0.1}$) have been presented for the first time, together with an updated inventory for MP_{10}. These show that the relative importance of road transport increases with decreasing particle size.

The Airborne Particles Expert Group (APEG) was established in December 1997 on behalf of the Department of the Environment, Transport and the Regions, The Welsh Office, the Scottish Office, and the Department of the Environment (Northern Ireland).

- The APEG report is available from the DETR Internet site: *http://www.environment.detr.gov.uk/airq* or by telephoning the Public Enquiries Unit: 0171 890 3000.

Viewpoints on the environmental profession

Earlier this year IEA and EARA published in their Journal a number of statements from leading environmental bodies setting out their viewpoints on the environmental profession. These included a statement by the IES. For some time now all of these bodies, together with several others, have been exploring possibilities for collaborative action and closer working relationships. It should therefore be of some interest to members to understand the ethos of fellow professionals in a rapidly expanding but as yet not clearly defined area of professional practice. The original statements are reproduced below.

The Institution of Environmental Sciences (IES)

The primary purpose of the Institution as a professional body for environmental scientists is to provide balanced, scientific information on the environment to members and public alike. The programme of activities ranging through meetings, seminars, conferences, workshops, publications and research have this fundamental purpose in view.

The Institution aims to develop within an interdisciplinary context and takes a holistic approach to environmental issues. From its inception in 1971 the Institution has provided a focus for the whole range of environmental subject areas and currently represents some 38 separate specialisations.

Key challenges

From a number of challenges facing the environmental profession we would emphasise the following:

- recognition of environmental sciences as a separate profession with related status for the importance of skills (recent surveys have indicated that the environmental sector attracts the lowest rates of pay for qualified scientists)
- wider acceptance of the importance of the environmental issues in the decision-making processes of both governmental and commercial organisations
- implementation of cross-boundary/frontier consideration of problems and problem-solving at all levels from regional to global.

Policy and professional development initiatives

In our opinion the following initiatives are needed to strengthen environmental management, in the broadest sense:

- the development of widely accepted codes of practice starting with ethical codes of conduct and progressing to more technical codes of practice and procedure
- the creation of stronger and closer working relationships between the professional institutions and government agencies
- the creation of similar close working relationships between the individual environmental institutions
- the encouragement of a higher profile for environmental professionals within industry and commerce.

IES response

IES has an active programme that addresses the majority of the key issues identified above and encompasses:

- the preparation and submission of responses to government departments and governmental agencies relative to consultations on environmental issues
- the development of closer working ties and co-operative activities with other environmental organisations
- the promotion of our code of professional practice which all Institution members are encouraged to follow
- the establishment of levels of professional competence as defined within our membership grades
- the publication of articles and position papers and the arrangement of seminars/conferences on key issues to stimulate public awareness
- the development of contacts with industrial and commercial organisations with a view to raising the level of recognition and support for the environmental profession within those sectors.

Professional standards and competencies

The professional standards and competencies required to promote an ethic of environmental care should be:

- the equivalent of, and certainly no less than, those required in the other professions of the sciences, architecture, engineering etc.
- the possession of a technical ability based on sound academic training and subsequent in-work experience
- a commitment to continuing professional development

Dr R. A. Fuller
Honorary Secretary
IES

The Institute of Environmental Assessment (IEA)/ Environmental Auditors Registration Association (EARA)

The IEA is an independent body established in 1990 to improve standards in environmental assessment, environmental auditing and environmental management systems. Key functions and activities include:

- review and advice on the quality of environmental statements, including those prepared by members
- operation of the EARA scheme with 1900 members, 40% of them from overseas
- administration of the Eco-Management and Audit Scheme (EMAS)

The IEA was recently designated as the competent body for this purpose

The decision of the EARA and IEA Councils to form a new expanded professional body responds to the evolving agenda for sustainable development and to the additional demands this is making on environmental management policy and practice. Every indication is that globalisation, the integration of national economics, will place increasing pressures on the environment and natural

resources. Other related market forces, including deregulation and privatisation, will make the task of addressing these effects more complex, and will require innovations in environmental strategy and action.

In turn, professional bodies will be called upon to provide relevant information, guidance and training to support environmental managers and practitioners and to equip them to operate in a fast changing situation. The market place in which these bodies operate will become increasingly demanding. Some urgent rethinking on future structures of co-operation and competition is probably overdue.

Getting the basics right

Despite recent advances, much remains to be done to improve standards of environmental management practice. Consider for example, the issue of assessing and controlling the environmental effects of development activities. This function is at the core of environmental management, and methods and procedures are well established. Yet environmental statements prepared under various regulatory and voluntary frameworks are uneven in quality and too many are poor or unsatisfactory.

This situation is the result of various constraints (e.g. time and cost limitation) but it also reflects adversely on professional competencies and skills. Step one in upgrading these is to get the basics right in identifying, reporting and controlling environmental effects. This objective needs to be generalised across all levels and sectors of government and business (notably including small and medium enterprises – SMEs). Unless it is achieved, we will be in a poor position to sign on to the more integrated, forward-looking initiatives that drive the sustainability agenda.

For IEA and EARA, the first concern must be to instil the knowledge, information, tools and skills (KITS) that will enable professionals to identify, report on and control environmental effects to defined standards of performance (see below). The application of the KITS approach to promote across the board, improvements in environmental management is a demanding task. But it is indispensable to further progress, ensuring that our visions of the future are capable of practical implementation.

Raising standards

What constitutes good practice in environmental management is defined by a series of interlocking measures. These include compliance with law, policy and regulatory frameworks, signing up to EMAS, ISO 14001 and other international standards or codes of voluntary practice and the use of qualified professionals, e.g. who are certified or registered under the various schemes operated by the organisations participating in this forum. In addition, professional bodies also raise standards by policy advocacy, by provision of advice and guidance on good practice and by training and networking activities.

Key priorities for the new IEA-EARA Institute include:

- providing categories of individual as well as corporate membership
- maintaining EARA as the flagship scheme for accreditation of environmental auditors
- accelerating the take up of EMAS by leading companies
- developing principles, guidance and case materials of good practice for environmental assessment and management.

An integrated approach to environmental management

The policy and institutional reforms that are necessary to achieve sustainable development are well documented, notably in Agenda 21 and in their national, regional and local equivalents. A call for integrated environment and development decision-making is a common theme of all of these documents. Far less evident is the application of the frameworks, process and tools, which are used or potentially available to undertake an integrated approach.

Environmental management in its broadest sense is a process of problem solving – designing and implementing a policy and organisational regime to protect natural assets, lower resource inputs and minimise waste outputs. In this regard, many EMSs remain incomplete and pro-forma. They meet ISO 14001 specifications for establishing policy and procedures and for auditing and reporting on their implementation, but lack the capability to relate EMS performance against environmental outcomes. This is an area where the IEA and EARA have credentials and intend to be active in continuing professional development activities.

Effects-based monitoring, auditing and reporting are indispensable means of understanding the environmental bottom-line of sustainable development. Unless these are in place, talk about sustainability remains just that and is unrelated to on-the-ground performance. Ideally, effects-based EMSs and processes should form part of a broader agenda to promote environmental management that sustains development rather than simply treat its side effects.

The new IEA – EARA Institute will pay particular attention to elaborating the basis of full cost analysis:

- environmental accounting to value natural resources and estimate the depreciation caused by loss and damage
- '3-E' assessment to address the environmental, economic and equity impacts of development proposals
- environmental auditing of the outcomes of the EMSs (e.g. resulting from terms and conditions attached to ESs).

Foresight in the future

Environmental management must become an integral part of the mainstream of practice and corporate policy-making; a proactive process that shapes the course of development rather than control its side-effects. Strategic environmental assessment and other options appraisal tools are being increasingly used in the UK and internationally to gain leverage on policy function. However, the potential is yet to be fully exploited; e.g. by developing sustainability indicators and measures that facilitate 'distance to target' assessments of development proposals.

Looking further ahead, fundamental questions about the environmental consequences of development trends must be squarely confronted. The professional bodies concerned with environmental management and science should be leaders in pressing this course of action, possibly by using the Foresight programme launched by the DTI Office of Science and Technology (public consultation is underway on the next round of activities). Foresight involves developing a vision of the future and anticipating the consequences for tomorrow of decisions and actions taken today. Using the expertise available through professional bodies, long-term, large picture

assessments of the environmental implications and impacts of development scenarios for the UK could be undertaken.

The purpose of such exercises is not so much prediction of what could occur as projecting the range of possibilities in order to inform policy choice about what to aim for and what to avoid, namely the continued liquidation of natural capital and the foreclosure of environmental options. With the Millennium approaching, here is the nucleus for the environment profession to articulate a coherent vision and an agenda for future action.

Barry Sadler
Chief Executive
IEA

Institute of Environmental Management (IEM)

IEM is committed to the promotion of more sustainable business practices in industry, commerce and local government.

To achieve this we will endeavour to help our membership evaluate both short and long-term challenges faced by their organisations by helping to raise levels of awareness, by promoting the growth of new skills and by catalysing the development and use of innovative management practice.

In our own work, we will take all possible steps to minimise the impact of our activities on the environment and to identify increasingly sustainable ways of fulfilling our organisational goals.

Environmental management is moving faster than ever. We are now entering another period of rapid change, one that is more fundamental, propelled in great part by a growing awareness among policy-makers in government and business that the environmental challenge is real and increasingly urgent. IEM has seen the agenda move on in leaps and bounds, issues just surfacing among our membership two years ago are now part of the common vocabulary; issues like eco-efficiency, design for the environment, environmental accounting.

The IEM's annual surveys have plotted over the past five years the evolving role of the environmental manager and its most recent finding is that a growing body of membership feel strongly that they have a key role to play in helping their organisations develop strategies for environmental change, strategies which make environment a mainstream business issue. Having focused for the last few years on the implementation of systems, legal compliance, waste and cost minimisation, many IEM members are now looking to the longer-term, projecting future trends and helping to steer their organisation to successfully ride them.

Although too many managers still resist the fact that the stability of their organisation ultimately depends on being in balance with the natural environment and resource base, there is no getting away from that fact – and it is the environmental manager who is best placed to interpret what this does, or might mean, for their business. A growing number of systems and compliance-oriented managers are breaking out of the mould. Joined by a small band of strategists they are beginning to look at more fundamental issues, issues to which many of them expressed considerable hostility two or three years ago.

Design for the environment, responsible production, resource accounting, sustainability – a growing group of managers are trying to understand what these mean for their businesses even if they are yet to turn these thoughts to meaningful action.

Managers alone will not deliver a sustainable organisation. Their role is to use their imagination to make their organisation as sustainable as possible within a given framework. There are now signs that in some key areas the framework will change, for example in the area of transport. As this change takes place it will offer ever more opportunity for managers to develop and implement the type of schemes that the more adventurous among them are already exploring.

But to liberate the potential for change, and in the longer-term to keep up with it and to stay competitive, many managers and their advisers will have to change the way they think about the environment and to move away from trite slogans about the bottom-line. Of course business needs to make money, that is not in question. But in order to make money they need to be aware of and react to their surroundings, to the real frameworks within which they operate.

The environment is one of the key components of that framework, and always has been. This needs to be acknowledged in order for environmental managers and advisers to get the recognition the IEM believes they deserve. Once the most senior managers realise that they need to understand the broader implications of environmental issues for the way their organisations develop, they will realise just how much they need informed advisers to help guide the way.

Slowly but surely, the "traditional" environmental manager is developing his/her role as an environmental adviser spreading and developing management awareness of the bigger picture. A growing number are developing their roles in informing and directing corporate strategy and business development.

The most successful have an attribute in common, they are able to challenge preconceptions and to see that there are different ways of doing things. The IEM's role is to support and encourage this ongoing challenging of the status quo, and to help its members find better, and more constructive ways forward. It is this characteristic, probably more than any other, that will shape the ability of the environmental manager to succeed into the next millennium as the talk turns to action.

Alex Peckham
Chief Executive
IEM

The Chartered Institution of Water and Environmental Management (CIWEM)

CIWEM is an independent professional body representing over 12,000 managers and other professionals, in the public and private sectors of an industry which is responsible for the stewardship of this country's water and environmental assets. CIWEM's agreed purpose is to develop and promote the better and integrated management of all aspects 0f the natural environment; to foster a better understanding of water and environmental issues and to enhance the quality of life for individuals and communities. This is achieved through its Royal Charter; education, training and professional development; dissemination of information; events and conferences; research and publications; contact with Government and national agencies and

partnerships with other professional bodies.

Although CIWEM may not be familiar to all readers, the range of services and activities provided by its members will be, since we are all reliant on water services, environmental research and good practice management for an improved quality of life. These and related functions are an integral part of a successful environmental industry; and the important research being done an climate change, pollution control and sustainability, by CIWEM and its members, is of fundamental importance to all industries and national and local government. But it is not just the science of water and environmental management where CIWEM is active. It is not generally known that the Environment Agency and the Water Utility companies have a statutory remit to provide for recreation and many CIWEM members are professional managers performing this important role. The Thames Barrier, apart from its obvious purpose, is also a major recreational attraction. Water and environment issues touch all our lives in all sorts of ways and impacts on many other professions.

A growing world population, ever increasing consumer demand, the drive for more from less, greater public awareness, diminishing natural resources and climate change, has put our natural environment under tremendous pressure to meet conflicting needs whilst retaining its unique characteristics and diversity. These pressures translate into significant problems, challenges and opportunities for those managers and practitioners who ore responsible far the care of the environmental infrastructure and water resource we all depend upon to sustain life. The work of CIWEM members, and the Institution, is therefore pivotal in any debate or discussion on environmental management and the quality of life issues. They are of huge proportions requiring global solutions to national and local problems.

Environmental matters are now high on the national agenda (although perhaps not high enough). The Government has indicated, for example, that significant amounts of national lottery money will be made available for environmental projects through the creation of the New Opportunities Fund. CIWEM, in partnership with others, now has an opportunity to influence how that aspect of lottery money could be spent. Investment in the environment, its management and the services we all depend upon, is essential and I hope that all relevant bodies will argue with a single voice for water and environmental management at the highest level; arguing for more resources and investment; arguing for a greater say in policy-making; and arguing for increased funding for more training, research and development. The environment industry (for that is what it surely is) deserves the support of those that service it, work in it and benefit from it.

In a highly complex and fast changing world no organisation can work in isolation. CIWEM believes that effective partnerships, between bodies, which share similar objectives and purpose, will be crucial to the future good management of the environment and the advancement of the profession at a national strategic level. Embryonic discussions on the concept of a "College of the Environment" are worth noting as a step in the right direction. But it is CIWEM's own recent initiatives on practical partnerships with other bodies, through *Memorandum of Understanding* which have the scope to energise debate and result in tangible benefits for everyone. Transport planning, tourism, recreation, economic development, landscape and urban planning, climate and pollution control and sustainability are just some of the disciplines where Institution's through partnerships, will need to share intelligence and speak with authority.

Sustainability, for example, is now an issue that appears on everyone's agenda for debate and action. Central, regional and local government, industry, agencies, professional bodies and special interest groups are all taking a view on the issue. However, there appears to be huge variances of understanding between those who developed the concept and those attempting to implement it and apply good practice. There are many reasons for this but the most important is uncertainty as to what sustainability really means and confusion caused by the lack of a common language. In my view a sustainable environment able to meet conflicting demands and pressures is dependent, in part, upon effective professional partnerships harnessing the expertise from within bodies like CIWEM, IEA, the Landscape Institute (LI), Institute of Leisure and Amenity Management (ILAM), the Institute of Horticulture (IOH) and the Royal Town Planning Institute (RTPI) for example, to provide practical advice and guidance on a subject where many landscape, environmental and recreational managers still struggle with the concept.

There are, of course, many other issues on which the industry needs to unite and work practically. We all know that environmental interests are seriously fragmented and would benefit immensely from the collaboration of those organisations within it. CIWEM advocates the mechanism of establishing partnerships through "Memoranda of Understanding". They provide a formal framework for practical actions and remind signatories of the need to overcome partisanship in the interests of developing common issues and achieving measurable benefits for environmental management, and allied professions, this represents the most pragmatic means of raising the status of those who work in it.

Although CIWEM is over 100 years old it was borne of a merger of two professional bodies in response to changes in the profession and the needs of its members. The most recent amalgamation of two trade bodies to create "Water UK" also reflects industry changes. The number of people employed in certain areas of the industry has diminished dramatically in the last 20 years and practitioners now need to be multi-skilled. Consequently the current range of industry bodies cannot, in my view, be justified in either economic or practical terms and they will continue to compete for members until a sustainable and common voice for the industry is ultimately achieved or real practical partnerships are in place.

The challenges for the profession include an ability to respond to complex issues which cut across disciplines. The most successful environmental practitioners (the pioneers) will be those who can cut through the traditional boundaries of engineering, planning, landscape, transport, recreation, economic development and social sciences. The profession must also make itself more readily understood and harness public support. The issues are global and too important to be left to the experts alone.

Nick Reeves
Executive Director
CIWEM

The Hon. Secretary's news desk…

Change of Chairman

The Annual General Meeting on 8th March will mark the conclusion of four years of service by our Chairman of Council, John Baines. John will have served a little longer than most of our Chairmen and we are indeed fortunate that throughout this period he has maintained a high level of interest in and commitment to Institution affairs. His Chairman's Report in the Annual Report 1998 summarises the progress made and the achievements during his term of office. This impressive record is a tribute to John's enthusiasm and leadership. I know that I speak for my fellow officers and colleagues on Council when I say that it has been a pleasure to work with him over the past years. The good news is that John is continuing on Council and Education Committee to develop the Institution involvement with environmental education and sustainable development – subjects with which he has had considerable involvement already. We are therefore fortunate in keeping his experience and valued contribution.

We expect Will Pope, our present Vice-Chairman, to be confirmed as John's replacement and we wish him luck for his term of office.

Update on responses

Since my last review in October a number of responses have been prepared and submitted as follows:

- *Stability in Mineral Workings* to the DETR, prepared by Michael Evans.
- *Protection of Sites of Special Scientific Interest* to the DETR, prepared by Hugh Ellacott
- *Study of Energy and the Environment* to the Royal Commission for Environmental Pollution, prepared by Derek Lohmann.
- Liberalising Trade in Services to the Department of Trade and Industry, prepared by Richard Pagett and Robert Fuller.

In addition there have been a number of reports from the Education Committee to the HEFCE on Research 2001 and to the HEQC on quality standards.

Our busy period is continuing with three responses in preparation and several more in prospect.

Subscriptions and membership data sheet

Thank you to all those who have promptly returned their subscriptions for 1999. The welcome injection of cash has replenished our dwindling working capital. May I ask those who have not yet renewed to give this their attention as we also need income to replace earlier draw-downs on reserves. It will also save the considerable additional burden of sending out reminders.

In conjunction with the subscription invoicing this year you will have noticed that we are also asking for a confirmation of your basic membership information. This is to enable us to carry out a check and an update on our database. It would be of considerable assistance if all members could complete and return these sheets whether or not their circumstances have changed over the past year or two. We have been surprised to date to discover that some members are advising different addresses on their forms although we have received no prior notice of change! This we consider a matter of importance, as loss of contact through change of address is a significant cause of our regular loss of membership. Please remember to tell us quickly should your postal address change.

Tax incentives for environmental investment

In the Journal for January/February 1998 we published a short article by the Director of the Environmental Industries Commission. This gave details of their campaign to persuade government to introduce tax incentives for industry to promote the introduction of new environmental technology. This would be aimed at waste minimisation, pollution control, energy efficiency and 'clean' processes. At that time strong representations were made to ministers, members of parliament and senior civil servants for the introduction of measures to aid accelerated depreciation.

A further attempt is in progress and the campaign is being relaunched. As before, the Institution sees clearly discernible benefits in the scheme and is giving its support.

RAF

Forthcoming events and conferences

3-5 March 1999
Urban air quality, measurement, modelling and management
International Conference
Technical University of Madrid.
Details: Lucy Hamilton,
The Institute of Physics,
76 Portland Place,
London
W1N 3DH .
0171 470 4800

23-24 March 1999
The landfill options, the future of waste management
Berners Hotel, London
£749
Examines the EU Landfill Directive
Details: Anja Kneuer, IBC UK Conferences Ltd, Gilmoora House, 57-61 Mortimer St, London W1N 8JX
0171 631 3214

6-8 September 1999
National conference on emissions monitoring
University of Warwick
Announcement and call for papers, will cover legislation, stack and ambient measurement techniques, calibration, air quality and case studies.
Details: Dave Curtis, Source Testing Association
fax: 01462 457157
e-mail: CEM99@s-t-a.org

Environmental toxicology well presented

Title:	**Pollution Risk Assessment and Management**
Edited by:	**Peter E. T. Douben**
Publisher:	**John Wiley & Sons, 1998**
ISBN No.	**0 471 97297 5**
Price:	**£85: 464pp, hardback**

The timing of the publication of this book is appropriate in that the author, Peter Douben, is a member of the Royal Commission on Environmental Pollution and this body is currently the subject of a review by Government of their work, composition and effectiveness.

The nature and assessment of risk attaching to pollution of different kinds and the possible methods of managing the risk have been subjects of interest at both professional and governmental levels for some time now. During 1998 the Royal Society of Chemistry published two paperbacks dealing with aspects of the subject, both of which were reviewed in this journal.

In common with the RSC publications, this book is made up of a number of papers by distinguished contributors, each on a different topic within the overall framework. The authors come from the UK, Canada, USA, Netherlands and Germany and therefore draw on a wide range of experience in both Europe and North America.

The range of this collection of papers gives an extensive and comprehensive introduction to the principles of integrated pollution control and its relationship to risk management. The content begins with the place of industry generally, followed by some examples of industrial process regulation in a number of industrialised countries. The nature of pollution to the atmosphere, water and to the earth and groundwater are all separately examined and processes in use for their assessment described. Standards for human health protection are investigated including the complex topic of pollutant effects. The importance of ecological aspects is also covered in a study of ecological risk assessment.

The strategic risk assessment framework is broadened in the later chapters by a rare departure into the realm of environmental economics and also the important factor of the effect of legal and political considerations on processes of environmental management.

The papers are technically soundly based and well presented, readable and comprehensible for the non-specialist and a valuable and contemporary source of information for all those involved in the science of ecological and environmental toxicology.

Dr R. A. Fuller

New members

The IES is pleased to welcome the following to membership of the Institution:

Sponsor Member: United Utilities PLC, Warrington WA3 7WB

Mr A. E. A. Barnard	Chairman & Managing Director International Business Action Ltd.
Ms. C. Brenton	Student
Dr B. Collins	Senior Environmental Consultant Tobin Environmental Services Ltd.
Mr P. H. Dyke	Independent Consultant PD Consulting
Miss. C. E. England	Student
Mr J. C. Fan	Recent Graduate Cranfield University
Mr N. A. Harris	Student
Mr J. S. T. Hodgkiss	Senior Consultant Stats Environmental Consultants Ltd
Mr M. P. Ireland	Environmental Engineer Mott MacDonald Group
Mr P.D. Jaipal	Student
Mr E. W. James	Student
Mr K. D. Jensen	Student
Mr G. O. Jones	Student
Mrs U. Kempster	Student
Mr R. B. Lightfoot	Student
Miss S. F. Morris	Student
Mrs S. L. Murphy	Claims Technician McLarens Toplis Loss Adjusters
Mr A. J. O'Dea	Senior Geo-Environmental Engineer WSP Environmental Ltd
Miss M. Owen	Environmental Consultant Ashdown Environmental Ltd.
Mr M. R. Phillips	Senior Lecturer/Programme Leader Swansea Institute of Higher Education
Ms. E. Rowan	Student
Mr J. S. Taylor	Recent Graduate University of Sunderland
Mr H. W. Thomas	Student
Miss A. F. Tracey	Recent Graduate Manchester Metropolitan University
Mrs C. A. Turner	Student
Mrs G. Webb	Student
Mr S. M. Webb	Recent Graduate University of Westminster

Diary dates 1999

8 March	Education Committee	10.30
8 March	AGM followed by Council	13.30
8 March	Burntwood Lecture	18.30
19 April	GP Committee	13.00
16 June	Education Committee	10.30
16 June	Council	13.30
6 September	GP Committee	13.00
6 October	Education Committee	10.30
6 October	Council	13.30

New IES address

The Institution's new postal address is:

PO Box 16, Bourne, PE10 9FB

The telephone/fax number is: 01778 394846.

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