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FEATURE ARTICLES

Alien invaders: grasping the nettle

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Under siege

The foot and mouth crisis demonstrates only too clearly the dramatic impact of an invasive alien species (IAS) in the UK. It is the latest and most catastrophic example of the growing threat from non-native species, ranging from microbes to mammals, that have become aggressive invaders.

While UK agriculture has battled a succession of invaders, few other parts of our national life have escaped the ravages of IAS: concrete walls falling to Japanese knotweed, water voles hunted by minks, native crayfish in retreat from escapee farmed relatives, spruce forests invaded by bark beetles, red squirrels squeezed out by North American grey squirrels, and earthworms decimated by New Zealand flatworms. Solutions have been found to some problems, more await resolution, while more continue to surface. Many have captured the public's attention, yet despite the alarm raised, there is still no coordinated effort to deal with IAS issues in the UK.

Why have IAS become an issue at this point in history when we have been trading in alien species for centuries? Horticulturalists, for instance, have a colourful history of bringing us weird and wonderful plants from far-off lands, and delicious vegetables to enhance an impoverished menu. The key point is that only a small minority of non-native species become problematic. The costs, however, can be immense in terms of loss of indigenous species, environmental damage and investment in eradication measures. For example, it will cost £1-3 billion to eradicate and revegetate the UK's still-expanding Japanese knotweed invasion, which affects recreation and landscape access, viability of flood defences and damage to urban facilities and infrastructure.

IAS problems are not new to the UK (ground elder was introduced by the Romans) but until recently they have been relatively rare. Reasons for the increased threat are multi-faceted and interlinked. Most important is the enormous increase in the number of species being moved globally in recent decades. Natural barriers to species movement have been breached through increased trade and travel, while land-use change and global warming facilitate the establishment and spread of these species.

The global threat from IAS was highlighted at the UN Conference on Alien Species in Trondheim, Norway in 1996. This landmark meeting, convened in response to a call from the Convention on Biological Diversity (CBD) for parties to take action on IAS, recognised invasives as the second greatest threat to biodiversity after habitat destruction. This is more than a threat to pristine ecosystems, for biodiversity is the sum total of a country's flora and

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fauna, including domesticated and agricultural species. IAS are striking for their cross-sector impact on biodiversity, health and economies, witness foot and mouth.

As a signatory to the CBD, the UK has an obligation under Article 8(h) to 'prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats and species'. The Trondheim conference showed that most countries had insufficient awareness, information or capacity to address their IAS problems. This is true for the UK.

Existing defences

The Wildlife and Countryside Act 1981 is the principal legislation. Under Section 14, it is an offence to release or allow escape into the wild any animal 'of a kind' not normally resident in, or a regular visitor to, the UK. Unfortunately, that is as far as it goes. There are no prohibitions, for example, on alien vascular plants except Japanese knotweed and giant hogweed, which highlights another failing: the Act deals only with species already causing problems in the UK, a limitation compounded by the lengthy time-scale of the review process for emerging problems. Enforcement provisions in the Act are woefully inadequate and effectively unenforceable. There is no requirement for compulsory prerelease testing and confusion over interpretation has meant very few prosecutions. Alarmingly, it appears that although the Act will be strengthened by a current revision, virtual immunity is likely to be given to the horticultural industry, historically responsible for many of the worst invasives including garden escapees such as Japanese knotweed. The Countryside and Rights of Way (CROW) Act 2000 has made some progress in increasing penalties for contravention.

The common law of nuisance has been used to control IAS, with civil actions instigated by individuals. Statutory nuisances allow a more streamlined remedy by local authorities; for example, prosecutions have been undertaken under the Public Health Act 1936 against riparian owners in Scotland who allowed giant hogweed growth to impede water flow.

The Plant Health (Great Britain) Order 1993 prohibits or strictly controls importation of invertebrate pests and/or soil, plants and plant products that could carry disease threatening local agriculture and horticulture. However, there is no effective system for regulating entry of all new species to the UK, a mechanism that would effect control at an early stage. The problem extends beyond the UK, because the European free-trade area allows unrestricted movement of many species.

Plugging gaps

The promised fundamental review to facilitate development of a policy on invasive species (Section 10.3.5 of the Rural White Paper Implementation Plan) should lead to changes. But what should these changes be?

The Joint Nature Conservation Committee (JNCC) emphasises the importance of learning from nations with more experience of IAS, such as the USA, Canada, Australia, South Africa and New Zealand. Importantly, their knowledge is now supplemented by an international process of knowledge sharing. The Global Invasive Species Programme (GISP) was set up in anticipation of the increase in demand for knowledge on IAS and operates through CAB International, IUCN (World Conservation Union) and SCOPE (Scientific Committee for Problems of the Environment). The international initiatives are focused on understanding the causes of IAS and identifying key interventions that need to be developed, strengthened or enforced. Guiding Principles from the Conference of the Parties to the CBD advise countries how to fulfil their obligations under the convention.

The first line of defence should be prevention, which is far more environmentally desirable and cost-effective than any post-invasion measures. Ideally, we would want to predict what species pose the greatest threat, and identify pathways of invasion so entry can be blocked. In the case of rabies, awareness of the impact of invasion led to effective long-term exclusion measures. We can build on experiences of other countries and similar species and make risk assessments. Many probable or proven invaders are arriving and spreading in the UK without hindrance, because current retrospective regulation is enacted too late.

Once an invasion has occurred, early detection and a rapid coordinated response are crucial to a successful outcome. Appropriate monitoring schemes need to be in place together with a team trained to deal with the problem. If detection occurs swiftly, and if appropriate control measures exist, eradication is the first choice for control, as it was for foot and mouth.

In many cases, an established IAS may spread beyond the realms of feasible eradication and the emphasis has to be on containing spread and mitigating environmental and economic impacts through appropriate control measures. These should hinge on integrated pest management (IPM), an approach combining information provision, best control practices and impact assessments. Control methods may include physical constraints, mechanical removal, rational chemical use, cultural practices and release of biological control agents, together with restoration of native species.

Countries with a long history of IAS problems rely on biological control for effective and economic IAS management. Where programmes are soundly put together and underpinned by good science and proper monitoring, success rates are high. Over 80 per cent of weed biological control programmes in South Africa achieved complete or substantial control. Australia estimates 45 per cent returns on investment over the next 30 years for one weed biological control programme. Biological control has never been used against weeds in the UK (or indeed Europe as a whole), although we have a number of good candidate weeds. In contrast, the horticulture (especially glasshouse) industry relies increasingly on biological control for invasive pests such as whiteflies, and forestry has used natural enemies, for instance against bark beetles.

Engaging support

Research supports each stage of the response to an IAS

and needs to be targeted and adequately funded. Poorly funded studies generally produce poor results whatever the effort put in. This underpinning work should consider 'novel' methods of control applied as a matter of course in more experienced countries.

Many successful IAS control programmes have public buy-in from an early stage. The idea of one innocent-looking species having country-wide impact is difficult for people to grasp and the potential for damage needs to be made very clear. National awareness programmes in New Zealand, Australia and North America are particularly effective, and these can be linked to education initiatives in schools.

Summary

The UK cannot sit back and watch as invasive species undermine the environment and economy, indeed the CBD prohibits this. Lessons need to be learned from other countries and international initiatives. We need to create a positive policy environment for dealing with IAS. An international Code of Conduct provides tried-and-tested guidance for countries developing legislation on the import and release of biological control agents. CAB International is at the forefront of UK-based organisations providing international support on IAS management. The time is ripe to harness this expertise to tackle IAS problems in the UK.

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CABI Bioscience, a division of CABI International, has unique global expertise in the prevention and management of invasive species.

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The behaviour of fine particulates (PM_{10}) in thunderstorms

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Particles are a range of compounds and substances present in the atmosphere. They may be naturally occurring or be man made from either combustion or activities that will produce dust, for example agriculture. The problem with particles is that they are respirable below certain sizes, and less than 10 microns in size may penetrate deep into the lung. That fraction of particulate less than 10 microns in diameter is commonly known as PM_{10}.

PM_{10} is increasingly being linked with morbidity and mortality. The research is continuing, but to date it appears that it is the ability of some of the particles to penetrate deep into the lung alveoli, from where they are not easily removed, that causes some of the health effects. Inflammation of the airways may result, which is linked not only to respiratory illness, but also to cardiovascular disease. Some particles may also be carcinogenic. (It is important to note that PM_{10}, unlike most other air pollutants, do not comprise one gas or compound but are a cocktail of substances). Particulates greater than 10 microns are considered to be less important as they are unlikely to penetrate into the lung, being removed by the body's protective mechanisms.

Air Quality Standards and Objectives for particulates exist. These were originally contained in the Air Quality Regulations 1997, and arose from the 1995 National Air Quality Strategy and the 1995 EPAQS (Expert Panel on Air Quality Standards) recommendations. The requirements of the regulations were relaxed in 2000 following the review of the National Air Quality Strategy in 1999, the issuing of a new National Air Quality Strategy, and new Air Quality Regulations in 2000. The current air quality objectives are limits of 50µgm^3 24-hour discrete mean and 40µgm^3 annual mean. Both objectives have to be achieved across England by the end of December 2004, but in the case of the daily 24-hour discrete mean up to 35 exceedences are allowed per year.

It is the responsibility of local authorities to secure compliance with the objectives; and where they are unlikely to be met, to require steps to be carried out to meet them. It is, therefore, important for a local authority to be able to determine where its PM_{10} is coming from. There may be many sources of PM_{10}, natural, for example sea salt or airborne sand, and man made. The man made may be primary (i.e. emitted directly) or secondary (formed from other material in the atmosphere such as nitrates and sulphates). The main sources nationally are believed to be combustion processes, such as road transport, power generation and industry. This may vary locally. Some local authorities are having filters from their monitors analysed (either chemically, microscopically by electron microscope or by both methods) in order to try and ascertain their particular sources. My belief is that there may be certain natural events that should not be overlooked in this search.

South Somerset District Council owns and operates two air pollution-monitoring stations. One is at a rural background location, where there are two analysers, an R&P 1400 TEOM PM_{10} analyser and an API ozone analyser. (The Ozone analyser forms part of the UK

Automated Urban and Rural Network.) The other is an urban monitoring station in a busy market town where there are oxides of nitrogen and TEOM PM_{10} analysers.

The rural site

Being a rural site with no nearby sources of pollution only background concentrations are measured. For particulates these are normally low (see Table 1).

Table 1

Year	Mean Concentration (TEOM corrected) µgm³
1998	17.7
1999	18.6
2000	18.2

The urban site

This site is situated within 10m of a busy road (35,000 vehicles per day). It is a new site only commissioned in March 2001. Early results show a very similar pattern to the rural site (some 12 miles away) but almost continuously a 5-10µgm³ greater concentration.

Unusual events as a source of PM_{10}

High concentrations do occur from time to time, which are thought to result from natural sources, such as Saharan sand (as on 2nd March 2000 when a 15 mean peak of 233µgm³ was measured (uncorrected). This storm can be seen over the Atlantic Ocean and North West Africa on satellite images). However, a further source of natural particulates should not be overlooked, namely that associated directly or indirectly with meteorological events, such as thunderstorms.

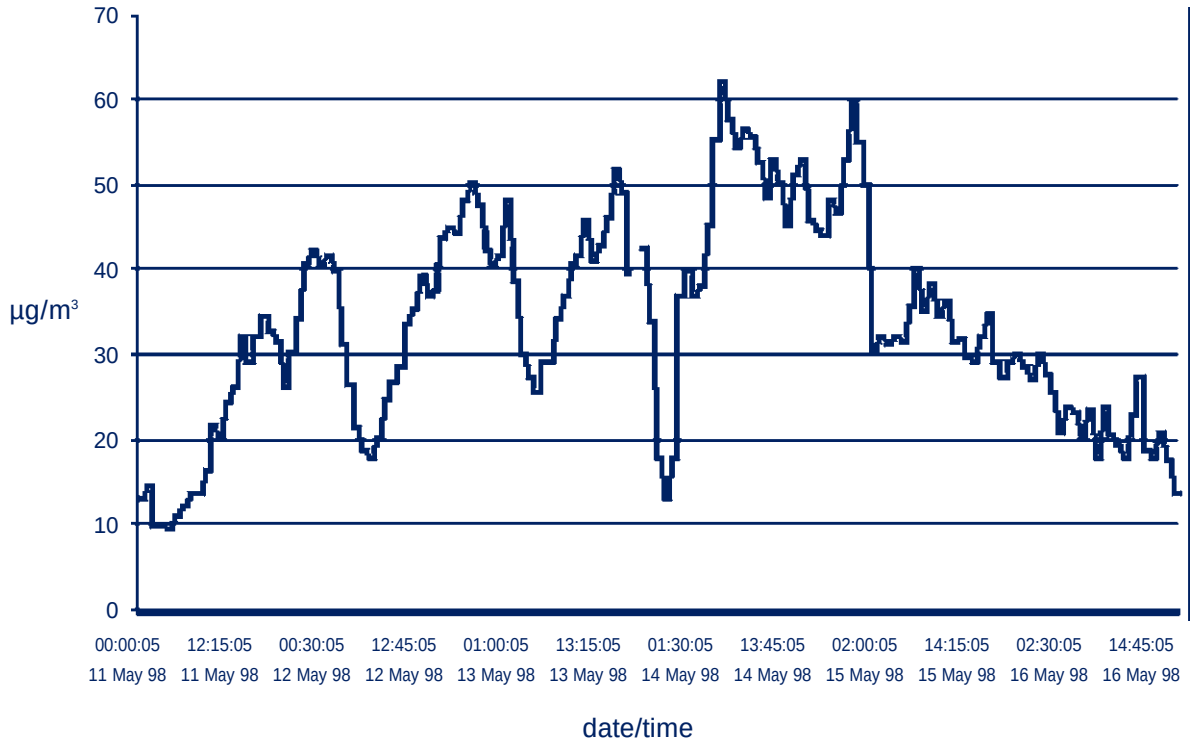
The first storm

From PM_{10} data gathered at our monitoring stations it has been noted that PM_{10} concentrations tend to be elevated around the time of thunderstorms. Graph 1 shows concentrations building up before, during and after a thunderstorm on the late evening of 13th May 1998. The concentrations can be seen to increase from the normal baseline of 10-20µgm³. (The period of the storm was from approximately 10pm until 2am and can be seen by a small gap in the data collected, due to the storm knocking out electrical supplies in the area.) As might be expected the very heavy rainfall that occurred appears to reduce PM_{10} concentrations. However, very shortly afterwards concentrations rapidly increase again, reaching their peak, and then gradually reducing.

The second storm

On the afternoon of 25th August 1999 the normally unattended rural monitoring site was being visited for some routine maintenance. At the start of the visit slightly higher than normal concentrations of PM_{10} than normal were being displayed by the analyser, 19µgm³ (uncorrected), whilst ozone concentrations were 14ppb, a low figure for this time of day in the summer. The concentrations were relatively stable, initially, but after about 20 minutes a thunderstorm could be seen approaching from the west. The PM_{10} concentra-

Graph 1: PM10 Concentrations (storm at apporoximately 10pm-2am)



tion increased rapidly during a five minute period to 39ugm^3 and at the same time the ozone concentration decreased to 8ppb, a low concentration for summer daytime. The PM_{10} concentrations then proceeded to oscillate rapidly on what appears a cyclical basis from peaks of 30µgm^3 to troughs of 13µgm^3. This cycle continued until the storm arrived overhead, and heavy rainfall started, when PM_{10} concentrations immediately dropped to 5µgm^3 whilst ozone concentrations rapidly increased to 45ppb. During the storm ozone concentrations decreased and then remained in range of 35-39ppb. PM_{10} concentrations remained below 5µgm^3.

Shortly after the storm had passed, pollutant concentrations returned to more 'normal' levels. Graph 2 shows PM_{10} and ozone concentrations measured during this period. It is noticeable that while the initial pattern of low ozone and higher PM_{10} is seen as the storm approaches, with the rapid increase in ozone and drop in PM_{10} concentrations being observable as the storm passes overhead, the rapid fluctuations cannot be seen. This is likely to be because the analysers, while measuring continuously, are only storing 15-minute mean data, which may mask very short-term events. It is unusual to witness this as most monitoring sites are unattended. The ozone concentrations immediately prior to the storm would be reduced by the dense cloud cutting light levels. However, during the storm the rapid increase in concentration, I would suggest, is the result of atmospheric turbulence; perhaps stratospheric ozone being brought down to ground level, or may be generated by the high voltage electrical discharges of the lightning.

The third storm

An electrical storm in May 2001 near our urban PM_{10} monitoring station can also be seen to be associated with elevated concentrations of particulates. Once again power supplies were disrupted during the storm, hence the gap in the data.

The causes and effects of these events

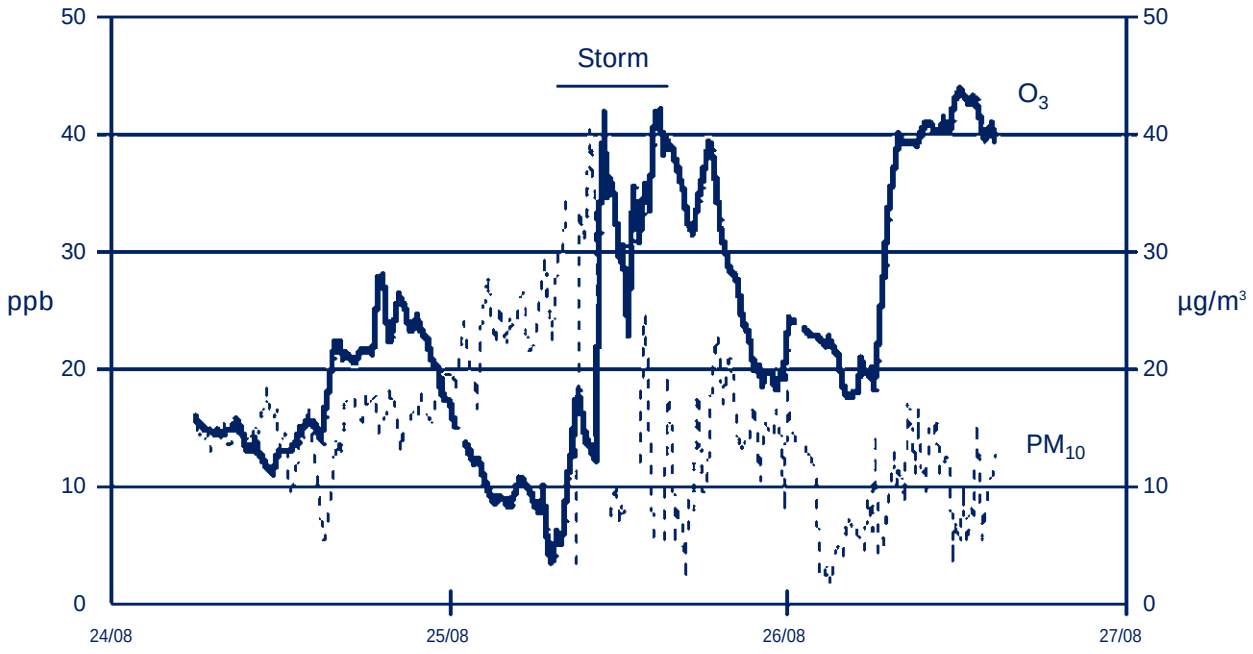
The behaviour of the particulates immediately before and during and after these events indicate that unusual atmospheric conditions could play an important role in particulate concentrations, and should not be overlooked as a cause of high concentrations.

There are some references to the impacts of storms on particulates in the literature; recent research reported in the *New Scientist* (26th May 2001 'Wheezy Weather') reported a link observed by researchers in Australia between storms and particles. This research appears to have suggested that massive downdraughts of cold air could draw up pollen and dust in some storms and those pollen grains may rupture, releasing allergenic particles.

A storm in June 1994 has been associated with an increase in admissions at a London hospital. A report of a study into the storm in *Air Health Strategy*, January 1997, stated that there could be a link between storms and biological particles, and that certain storms could break down pollen into fine particles, which are more easily inhaled.

Based on observation of measured particle concentrations I would suggest that there could be seven principal sources for increased PM_{10} concentrations

Graph 2: Rural site measurements



immediately prior to, during or immediately after a thunderstorm.

1. Thunderstorms are often preceeded by periods of hot sunny weather. Such conditions favour the creation and build up of secondary pollutants such as ozone and secondary particles. These pollutants may be formed by the action of sunlight on other forms of pollution including sulphates, nitrates and oxides of nitrogen. This can be seen in the build up to the first storm.
2. High humidity that may occur in the run up to a storm may lead to the formation of aerosol particles. In the humid atmosphere a reaction of sulphates with water droplets may lead to particle formation (Airborne Particulate Matter in the United Kingdom, QUARG 1996).
3. Atmospheric turbulence immediately prior to the storm could re-suspend particulate matter from the ground.
4. Violent air movements in a storm could break up larger particulates (greater than PM_{10}) into smaller particles especially pollen which is normally larger than PM_{10} (10 to 100 microns).
5. Electrostatic charges in the atmosphere could attract particles from the ground and may generate particles by agglomeration of charged particles.
6. Lightning itself may generate particles by agglomeration of charged particles.
7. Fungi and plants may release spores and pollen into the atmosphere in response to the approaching rain (fungal spores being 5-40 microns in size). Rainfall may then wash out the particles from the atmosphere. Conversely the damp conditions immediately after a storm may lead to fungi and plants releasing spores and pollen, causing an increase in particulate concentrations, and this may be what is observed in the period after the first storm.

The observations made above and the suggested causes are only based on a limited number of events. However, they may be worth considering should high concentrations of pollutants or unusual pollutant behaviour be seen at times of severe atmospheric instability. Storms may prove to be important in respect of any area with exceedences of PM_{10} objectives. They may also offer some explanation for incidents of acute respiratory effects sometimes associated with storms.

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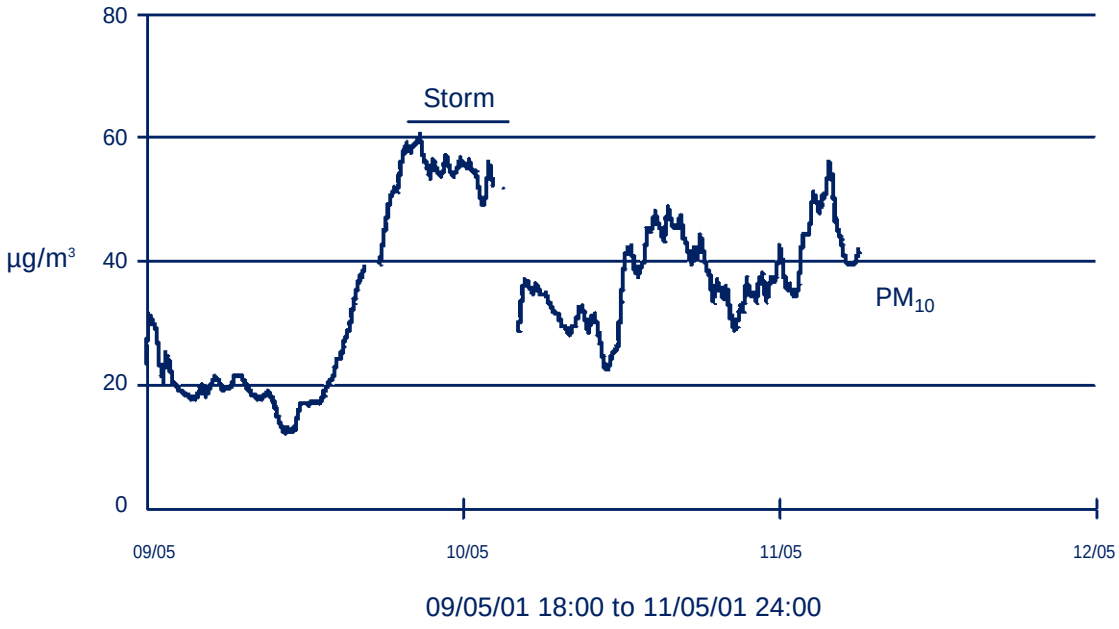
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, January 2000, The Stationery Office

Wheezy Weather, 26th May 2001, New Scientist

Thunderstorms bring misery for asthmatics, January 1997, Air Health Strategy

■ *The views expressed here are personal and not necessarily those of South Somerset District Council.*

Graph 3: Urban results



Vaccination against foot and mouth

Lord Soulsby of Swaffham Prior

The present outbreak of foot and mouth disease in the United Kingdom is unique: its explosive nature with many foci of infection emphasised the important ro1e of sheep in the spread of the infection. The casual agent is a virus (FMDV serotype O Pan Asia Strain) which is hugely infectious. While high mortality is seen only in young animals, severe lameness, permanent drop in milk yield, and poor weight gain are some of the features of this most contagious of animal diseases.

The control policy in the United Kingdom is cull of all cloven hoofed animals on infected premises within 24 hours. Similarly, animals on contiguous farms are slaughtered, if possible within 48 to 72 hours, though cattle which have been housed may escape the cull. Draconian movement restrictions on animals and materials are applied in a 3 km area surrounding the infected premises.

Why not vaccination?

As the total of slaughtered animals continued to rise and their disposal posed increasing problems calls for a vaccination programme became increasingly strident. To some, vaccination would appear to be an obvious approach: vaccines have been used to control and prevent other major animal diseases so why not foot and mouth? Indeed, foot and mouth is controlled in many countries by a regular programme of vaccination. Why not in the UK?

The answers to these questions are not simple. Three approaches using vaccination for control of an outbreak are:

- to replace culling with vaccination;
- to cull livestock on infected premises and 'ring' vaccinate in surrounding livestock premises or special animal groups;
- to adopt general vaccination of all livestock.

The first, to replace slaughter, would not serve as a control strategy. Animals that demonstrate clinical disease and those incubating the disease shed virus. Vaccination will not stop this nor the spread of the virus. The urgency is to remove the source of infection for other animals; slaughter out of the infected premises within the first 24 hours achieves this.

Slaughter out of infected premises with 'ring' vaccination has been practised in several countries. This approach is most effective in dealing with isolated outbreaks of the disease. The urgency is to stop the spread of virus and a high potency vaccine producing an effective immunity in as little as three days is required. A high 'payload' of vaccine given as a single shot can achieve this; the standard vaccine takes 7-10 days to achieve an acceptable level of immunity. This approach with the present outbreak was not appropriate as the infection had gone beyond the point where 'ring' vaccination might have been applied. The outbreak showed multiple foci of infection from Southern Scotland to the South of England.

Control by general vaccination is adopted in many countries, sometimes as a progressive strategy eventually leading to foot and mouth disease free status. The UK has never considered general vaccination to be a valid approach. The Northumberland Committee of 1968 set up to consider the 1967 outbreak of foot and mouth disease concluded that the slaughter policy was the best method of eradicating foot and mouth when it occurs in the UK. That report estimates the cost of general vaccination to be vastly greater than the slaughter policy. The Northumberland Committee did however recommend slaughter with ring vaccination but recognised that to be effective no animal movement beyond the area of this ring should occur. In the present outbreak no ring could be established!

The advantages of vaccination can be summarised as:

- vaccines of high immunogenicity are available;
- they can confer rapid immunity and protect susceptible animals;
- they reduce the level of virus released and hence limit transmission;
- sufficient doses are available (5 million) for ring vaccination but not for general vaccination.

The disadvantages include:

- availability beyond the 5 million doses;
- the vaccine is unstable and requires a 'cold chain';
- the immunity induced is of short duration (several months);
- there is high antigen variability;
- it does not prevent a persistent carrier state (virus may survive in the tonsillar tissue);
- differentiation between vaccinated and infected animals is not possible at present.

Adoption of a vaccination policy is fraught with difficulties of eventually achieving foot and mouth disease free status. With a policy of slaughter disease free status can be attained three months after the last case, but where vaccination has been used it may take up to two years.

What of the future?

Detailed molecular biology studies of the foot and mouth virus are under way in several countries with the hope of producing a robust vaccine, broad spectrum in nature to protect against all strains, of long duration, without any carrier state, and one which will induce not only high levels of antibody but also will eliminate infected cells. This is a tall order, but it is an objective which must be pursued. Foot and mouth is a global disease: it does not kill except in young livestock, but it is devastating to the economy of any country. We must have more effective tools and approaches to its control when next it gains entrance to the UK, as surely it will.

■ *Reprinted from Science in Parliament, Vol 58 No 3 Summer 2001, with kind permission of the publishers.*

Task force identifies next steps to recovery from FMD

Further action to help ensure the survival of rural businesses through the coming winter months and to revive the fortunes of the rural economy in the wake of the Foot and Mouth outbreak are the two key recommendations in a report to the Government from the Rural Task Force.

Key findings from the report include the need for future policies for farming to take better account of the links between farming and the wider rural economy, and a recognition that countryside tourism is a powerful economic force in many rural areas and is frequently worth more to local economies than the farming that supports it.

The Task Force believes that the pace and extent of recovery will vary between areas, and the full impact on rural businesses will take time to become apparent.

'The package of measures already put in place by the Government to alleviate the immediate financial difficulties of rural businesses has provided substantial help,' said Alun Michael, Rural Affairs Minister, who chairs the Task Force.

'The report acknowledges this but also identifies a risk of significant damage to the rural economy during the winter unless further assistance is provided.'

The report recommends measures to support the revival of the countryside including a review by the Government of the effectiveness of the various forms of assistance currently provided and whether more can be done to encourage take-up of the advice and help available. It suggests that the Government should continue to provide assistance until it is clear that the impact of the crisis is over.

Other recommendations include improving access to publicly funded advisory services, in particular creating a specialised support service to help tourist businesses, and further extending the capacity of farm business advisers to provide comprehensive individual advice on development and diversification.

Rural businesses and business organisations are encouraged to develop local supply chains and marketing networks, promote local distinctiveness and encourage local enterprises to buy food and services locally.

Also crucial to rural recovery is the need to attract visitors back to the countryside. The report proposes a major promotional campaign to relaunch the countryside based on a distinctive brand and theme.

At the same time local authorities and conservation and access organisations are urged to develop proposals to enhance access to rural areas.

Stronger conservation role given to zoos

Giving zoos a stronger conservation role is one of the measures outlined in a consultation paper from the Department for Environment, Food and Rural Affairs.

It sets out how the EU Zoos Directive will be implemented when the new legislation comes into force next April. Educational initiatives and research or information exchange on species conservation are some of the activities that zoos could be expected to undertake.

The directive seeks to protect wild animals and conserve biodiversity through a licensing and inspection system for zoos. Local authorities will have powers to close zoos which fail to comply with it.

New boost for green fuel

New Government grants will help up to two million extra motorists to buy cheap, green fuel.

The DTLR-sponsored programme gives grants to motorists to cover the cost of converting their vehicles to use low-duty Liquefied Petroleum Gas (LPG), which costs less than 40p per litre on garage forecourts.

Previously available only for purchase of new cars or conversions of vehicles up to a year old, the grant will now be offered to owners of cars up to five years old, and will cover up to 50 per cent of the conversion cost, which can range from £1,300 to £1,800.

Rural transport system 'must provide safety and choice'

The Government is committed to creating a rural transport system which gives people greater transport choice, improves road safety and conserves the countryside, according to Transport Minister Sally Keeble.

Speaking at a conference on managing traffic in the countryside, the minister said: 'We are determined to improve the opportunities open to rural communities. Better access to public transport is an important part of this. That is why we are targeting more resources to improve transport in rural areas. We are investing £239 million over the next three years in rural services, an increase of 54 per cent on the previous three years.'

She said it was important for people to get to and from their local market town and told how better bus services, introduced as a result of increased Government funding, were making a real difference on the ground.

The Minister also stressed the need to make rural roads safer. She noted concern among residents and others that traffic management needed to be both effective and sensitive to the surroundings. To this end, she announced that the DTLR had just let a research contract to TRL Ltd, which would explore more natural or psychological traffic calming measures.

■ The Countryside Stewardship Scheme – a cornerstone of the government's policy to conserve and improve the countryside – has celebrated its tenth anniversary.

Under the scheme, farmers are paid to follow traditional farming methods, with the aim of enhancing the landscape and encouraging wildlife.

DEFRA Minister Elliot Morley said the classic English rural landscape was a result of traditional farming practices over hundreds of years. Modern farming methods had changed that landscape and reduced the diversity of wildlife.

'By encouraging a return to traditional agricultural principles, we are slowly reversing those changes,' he said. 'Over the past ten years we've not only seen tangible benefits to the countryside, we also have the knowledge that we are helping our wildlife and our environmental heritage.'

Areas under Stewardship had seen a marked increase in previously declining bird species, including the bittern, reed bunting, greenfinch, pipit and wagtail.

Over 700 miles of dry stone walls and over 6,000 miles of hedgerow had been restored, and around 8,000 miles of grass margins had been established in intensive arable farming areas.

European Commission

Joint Research Centre contribution to climate change research and policy

Climate change is one of the JRC's main thematic priorities. A few examples of these studies are documented below. They show how the JRC plays a key role at the interface between research and both European and global climate policy. The JRC is also seeking to raise public awareness of the issues involved.

The global mean temperature of the Earth has risen by approximately 0.6°C in the 20th century. It is now accepted that this is due to emissions of greenhouse gases, mainly carbon dioxide (CO_2), by human activities. The IPCC forecasts that global mean temperature will rise by another 1.4° to 5.8°C over the next 100 years, a process which is expected to have a disrupting effect on life on Earth.

While in the developed world we could perhaps adapt to effects such as more extreme weather events or a rise in sea level, people in the developing world might not have this capacity. Resulting damage could trigger the dispersal of hundreds of millions of people and cause major upheavals in existing socio-economic structures.

Studying air pollution and climate change

Looking only at CO_2 is not sufficient for ratifying the Kyoto Protocol. Other greenhouse gases – including methane and nitrous oxide – and conventional air pollutants, such as ozone and particulate matter, have an impact on climate. Hence conventional air pollution and climate change issues are intimately linked. The JRC is studying the formation and behaviour of ozone and particulate matter in the atmosphere, to provide scientific input to future integrated air quality/climate change policies. As such, it contributes to processes like the European Climate Change (ECCP) and Clean Air for Europe (CAFÉ) programmes. JRC modelling shows that the concentrations of ozone and particulate matter have been increasing rapidly and are now a global problem. By 2025, Europe will also be affected by emissions in North America and South East Asia. EU legislation could be insufficient to safeguard our air quality, so international efforts will be necessary.

Modelling energy and climate scenarios

EU strength in Kyoto Protocol negotiations depends very much on knowledge about future developments in global energy needs and related greenhouse gas emissions. The JRC Institute for Prospective Technology Studies (IPTS) supports EU negotiators by making world energy projections, including hypotheses about economic growth, oil and gas market development and CO_2 constraints. IPTS is also involved in regional studies on energy demand, supply, trade and prices as well as performing assessment and impact analysis of technological breakthroughs and R&D-driven technical change.

Using European forest as carbon sinks

Monitoring implementation of the Kyoto Protocol will require the measurement of both CO_2 emissions and its capture by vegetation, at EU and global level. Measuring CO_2 sequestration remains a problem. In close collaborations with the DG Research CARBOEUROPE cluster, the JRC is studying and comparing various approaches – from foresters counting trees to earth observation from space. The ultimate goal is to use satellite observation combined with ground-based data and models of biospheric and human activities, to qualify both the emissions and the effectiveness of carbon sinks. Such an EU-wide tool can then be used to complement the emission and sequestration estimates provided by member states, on which the EU emissions inventory is based.

Climate change and the developing world

In addition to European forest carbon sinks, the JRC is also working on northern forest reserves and on deforestation monitoring in the developing world. Climate change in the developing world will bring about attendant environmental problems, notably increases in vegetation fires, desertification, scarcity of water resources and destruction of natural forest resources. These will have important impacts on human well-being, biodiversity and social stability. The JRC is working to build an environmental monitoring system, with accompanying databases, to address such problems at regional and local levels. The monitoring system will combine inputs from satellite observation and other spatially referenced data sources. By working closely with developing countries, the JRC is providing technical support to improve environmental management, and to facilitate the implementation of sustainable forest policies.

The 2002 Volvo Environment Prize

The Volvo Environment Prize Foundation was instituted in 1988 as an expression of Volvo's awareness of the interdependence of all actions, inventions and processes that sustain and protect our environment.

Why reward environmental research and innovation?

'Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs' is the definition of sustainable development in the Brundtland report from 1987.

The threats to the environment are numerous. Knowledge and understanding of the environmental, social, and economic interactions are fundamental criteria for sustainable development. The Volvo Environment Prize serves as a link between advanced research and industrial efforts by recognising people who have made significant contributions to our understanding of different aspects of environmental and sustainability issues.

The Volvo Environment Prize is awarded by an independent foundation, which was instituted in 1988. Laureates represent all fields of environmental and sustainability studies and initiatives.

What is awarded?

The Volvo Environment Prize is awarded for 'outstanding innovations or discoveries scientific, socio-economic, or technological, which have direct or indirect significance in the environmental field and are of global or regional importance'.

The prize rewards achievements. Priority is given to an individual or to a group of named individuals, rather than to institutions.

The prize

The Volvo Environment Prize is awarded annually at a ceremony in Göteborg, Sweden, and consists of a cash prize of SEK 1.5 million. A glass sculpture by the Swedish artist Erika Lagerbielke and an individually designed diploma by Göran Dalhov are the visible tokens.

How to nominate?

Candidates for the Volvo Environment Prize are nominated by universities, research institutes and their staffs, by scientists and engineers in the field of environmental protection, life sciences, earth sciences and social sciences, by national academies of science and their staffs as well as by other persons and organisations.

The foundation welcomes a wide range of nominations from all over the world including established as well as younger scientists, women and men, those who work in great institutions with modern equipment as well as those with limited facilities.

The prize committee is particularly interested in identifying younger scientists with a promising record of achievements in their respective fields, as well as scientists from developing countries. There is also a lack of candidates in certain areas. Thus, new nominations would be welcome in the areas of forestry, of toxic chemicals and hazardous waste, of land management and of transportation with regard to sustainable development.

Nomination forms are available on the Internet at www.environment-prize.com Nominations should be accompanied by name, title and address of the nominee(s), a CV and list of publications and a description of his/her/their achievements.

Nominations should be sent to Volvo Environment Prize Foundation, c/o Environment Affairs, AB Volvo, SE-405 08 Göteborg, Sweden, by 1st December.

UNED/WHAT merger

UNED Forum and the World Humanity Action Trust (WHAT) have merged with effect from 1st September.

This is the result of negotiations following completion of the work of three WHAT commissions and the publication of the WHAT Report *Governance for a Sustainable Future.*

The World Humanity Action Trust (WHAT) has been an independent think tank seeking practical resolutions to global problems

Jack Jeffries the Chairman of the Trustees of WHAT said: 'WHAT was set up in 1993 in response to a speech on Governance by Sir Austin Bide in which he perceived a widening gap between global problems and the human means for managing them. In 1998, WHAT set up three commissions in the broad area of governance to look at matters affecting humanity's common inheritance of oceans, atmosphere, and biosphere. We defined governance as the framework of social and economic systems and legal and political structures through which humanity manages its affairs.

With the completion of the WHAT Report on *Governance for a Sustainable Future* we believe we have made a substantial contribution to the debate on global governance. Our merger into UNED Forum is in recognition of the role that UNED Forum plays globally in briefing policy-makers in both governments and international institutions. WHAT believes that the ideas expressed in its report will be developed and propagated best as a department within UNED, focusing in the immediate future on utilising the Earth Summit in 2002 as an opportunity to move the governance debate forward.'

Derek Osborn UNED Forum Co-Chair said: 'It is clear that global governance is one of the issues that will be addressed by the Earth Summit in Johannesburg and as such UNED has already been inputting to the debate. The merger with WHAT will help us do this more effectively. It will give us access and support from the excellent commissions who were part of the WHAT work and build on UNED's unique understanding of the international governance process.'

UNED Forum now has a WHAT Governance department directed by Richard Sherman, based in Cape Town, South Africa. Richard Sherman is also head of the Research and Policy Unit at GLOBE Southern Africa, a parliamentarian group. GLOBE Southern Africa is collaborating with UNED Forum on the Governance project and actively involved in the preparations for the Johannesburg Summit.

Information on the work of the WHAT Governance Programme can be found at www.what.co.uk and further information on the Earth Summit 2002 process can be found at www.earthsummit2002.org

UNED Forum is a multi-stakeholder forum engaged in promoting the involvement of stakeholders in sustainable development. A report on global multi-stakeholder processes can be found at www.earthsummit2002.org/msp

How 11th September changed our attitude to travel – and the world

Dr Derek Hall

The swings and roundabouts of global events have been manifest in the wake of the terrorist attacks on the World Trade Center (WTC) and the Pentagon. In a capitalist world already heading for recession, airlines and related companies have found an opportune moment to retrench and restructure, shedding scores of thousands of jobs world-wide in the process.

While Americans are notorious for staying at home at the first sign of trouble elsewhere, and only around 10 per cent of US citizens have a passport anyway, the geographical context of the grotesque attacks on thousands of ordinary people is a relatively new phenomenon for the US public – many of whom are accustomed to travelling domestically by air on a regular basis – which is clearly going to need a little more time to work through.

Previous downturns in international travel following global crises – oil price hikes in the 1970s, the Chernobyl explosion and the bombing of Libya in 1986 for example – left relatively minor blips in the inexorable surge of global travel and especially of air travel.

If one can indulge in looking for, if not a silver lining then at least one less dark than the storm clouds around, it is that this neo-malthusian check on air travel may have a more lasting impact – and thus provide a slight breathing space for the global environment – than previous experiences.

We have all learned to live with airport X-ray machines and body searches, and the queues which precede them, and with irritating delays and lost departure slots due to the removal of bags from aircraft following a passenger no-show. Such precautions were installed largely as a response to the hijackings of the 1970s, and few of us can remember the earlier heady days of hassle-free flying.

Perhaps flying as an experience should be made more difficult and more demanding as an acknowledgment of its environmental costs. Perhaps air travel should be rationed less in terms of those who can afford to pay for it: which is certainly what the budget no-frills airlines have helped to achieve, as I recently experienced when flying from Scotland to London on a ticket fare which, before taxes, was 49 pence (yes pence) each way. But air travel could be availed to those who can endure the hardships and encumbrances that it should necessitate – the young and the more adventurous.

Any rationing process – whether based on an eccentric idea or due to the collapse of large numbers of airlines – should force governments (and the UK government in particular) to view more seriously, as the French have done, fast inter-city rail travel as the prime mode for domestic and shorter-distance international business travel. US rail company Amtrack has experienced a 40 per cent increase in its inter-city passengers since mid-September, yet it normally carries just 0.5 per cent of the US inter-city travel market.

Perhaps video-conferencing will now take a leap forward both in terms of increased use and improved technical quality, as an effective alternative to (perceived) potentially dangerous flights to business meetings. But where does that leave the burgeoning 'Third Age' market, those of retirement age who are both increasing their numbers and their thirst for travel?

That over 300 members of the New York Fire Department died in their attempts to rescue workers and tourists trapped in the twin towers is a tribute to the bravery of those we all too often take for granted. Yet the WTC's structural engineers must gain some consolation from the fact that the towers did as they were meant to do, collapsing in on themselves rather than toppling over across and onto one of the world's most densely populated metropolitan centres to cause considerably greater loss of life than was the case.

At the time of writing the New York subway under the WTC site is in a precarious position with the possibility of breach walls collapsing and the Hudson River inundating a significant section of the underground rail system with the subsequent possibility of further collapse. Yet there is also presented the opportunity to humanise this area of Lower Manhattan by developing on the WTC site something – a garden of contemplation perhaps? – in keeping with respect for the memory of the more than six thousand perished souls. Will mammon, on this most prized piece of global real estate, support the pursuit and physical expression of such an ethical statement as an integral element of the necessary rearrangement of this part of New York's urban environment?

Globalisation and internationalisation, however defined, are an essential ingredient of our lives. Ninety-two different countries were represented by those who died in the WTC, and the destruction of one edifice of global capitalism will only slow down some elements of the process – notably tourism – for a short while. Yet the inequalities which globalisation sets up, or at least exacerbates, must be addressed on a global scale if any lessons are to be learnt from these horrendous events. Hundreds of thousands of African children are malnourished and dying every year through neglect and greed: lacking the means to counteract dysentery, finding patented sugary drinks more accessible and cheaper than clean water, unable to afford basic medicines and remedies.

Africa is chosen in particular because virtually no major US media company has a permanent office anywhere in the continent. Much of Africa is seen as a 'basket case' and full of reminders of the lack of evidence of global 'progress' – social, economic and environmental – that should have been evident a decade after the end of the wasteful Cold War.

Perhaps the events in New York and Washington can help to bring a more holistic view to the world's decision makers, and a realisation that globalisation is at least a two-way street, with plenty of side roads and back alleys too.

A model for professional accreditation of university environmental courses

Derek Blair, Chair of the IES Education Committee

The Institution of Environmental Sciences (IES) is a professional body made up of environmental practitioners, academics and others whose interests and foci are interdisciplinary. It has been in existence since 1971. One of its long-standing activities, through its Education Committee, is to accredit university inter-disciplinary environmental courses – one of the few professional bodies that offers this service in the UK. Some 25 environmental courses in 11 separate universities have been accredited.

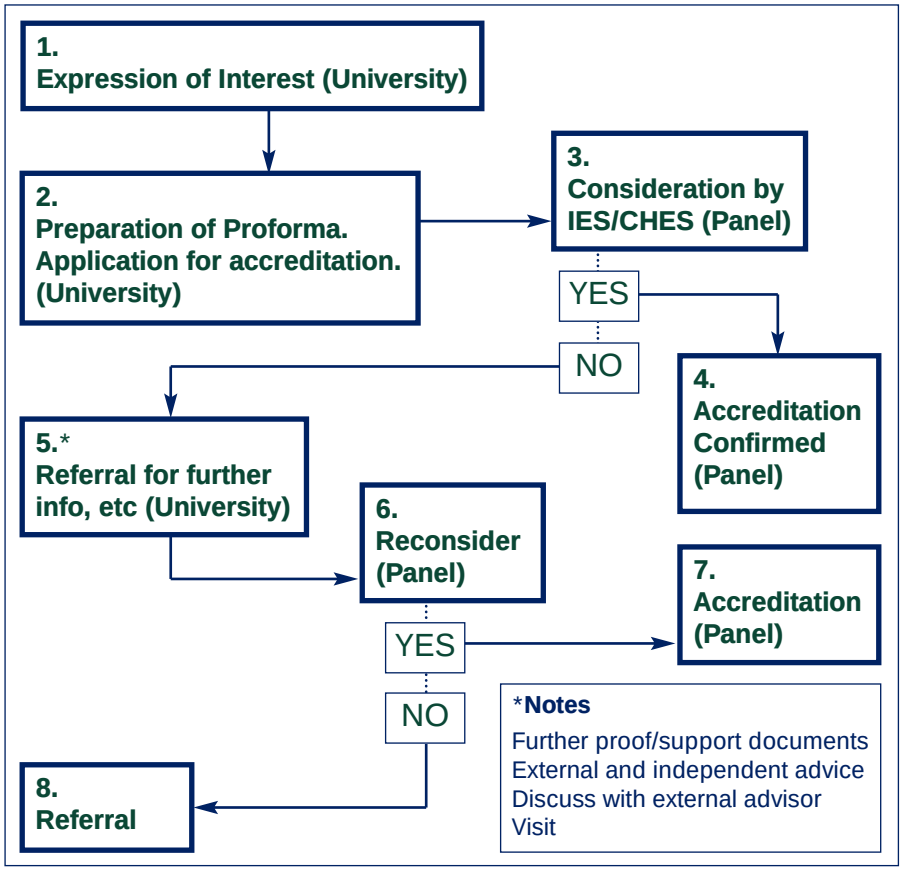
A downturn in the popularity of environmental courses in the UK over the last four years reinforces the belief in the IES that professional accreditation linked to academic qualification is an attractive and valuable opportunity for students wanting to work in the environmental sector.

Also, the professional and vocational relevance of environmental education and training has been given renewed impetus in the UK through benchmarking statements under the Quality Assurance Agency (QAA) which make more explicit the learning and teaching outputs specific to different disciplines at different levels. The IES has been collaborating with the Committee of Heads for Environmental Sciences (CHES) to refine its accreditation practice in line with this new development. The information given in this paper reflects the work of a recent joint working party made up of IES and CHES representatives.

Also, the IES has a significant international interest with 10 per cent of its membership coming from non-UK countries. The IES is and has been active in Spain, the Netherlands, Hungary and the Balkans through its consultancy, professional and academic links. It also staged a national seminar in July 1999 to publicise the EU ESSENCE project, which explores the relationship between graduates and the labour market.

This paper then sets out a model of how differing environmental courses can be interrogated from a professional standpoint. It presents in a simplified format the mechanism it is developing in the UK to identify generic, specific and other skills in students relevant to the environmental professions.

The IES model has potential value and advantage to students and universities across Europe. The ideas are easily transferable and the experience of the IES suggests that professional accreditation is a necessary and useful device to help to develop environmental qualifications throughout the EU.



The IES accreditation process

Definitions and interpretations

Broadly, the IES interprets an 'environmental sciences' qualification as one which follows from a course which

1. teaches an objective and scientific approach;
2. has a curriculum covering more than one specialism and has a significant interdisciplinary content;
3. involves and encourages an interdisciplinary approach;
4. embraces sustainability.

Inter-disciplinary areas of study are, for example: environmental assessment, auditing, environmental management, monitoring, and planning, environmental legislation and resources. Individual environmental subjects are, for example: air pollution, ecology, habitat management, landscape, waste management, water management, human ecology, noise. Other courses such as agriculture, energy, engineering, natural, urban studies and public health and modular courses that contain at least 60 per cent of related environmental topics, as indicated above, may also be deemed appropriate.

Aim

The basic purpose is to set appropriate educational standards for entry to professional membership.

Applications (see flow chart)

Accreditation applications are made by respective higher education institutions in accordance with their own approved mechanism and will be separate from academic reviews although utilising similar documentation.

A panel made up of IES and CHES

membership will consider the application with or without a related visit. A range of criteria will be used in the process, including judging the evidence and examples of:

1. generic skills (intellectual, practical, communication, interpersonal);
2. specific skills (professional practice, project management, career and professional development);
3. other skills (sustainable development, interdisciplinary).

Summary

The IES accreditation of environmental courses in the UK has been refined recently, in collaboration with CHES, to provide students with a potential professional benefit.

The model outlined should have transferability value to other European countries and is relevant in the debate about university education and the labour market.

CONFERENCE REPORT

New directions in managing rural tourism and leisure

The Scottish Agricultural College (SAC), Auchincruive, Ayr, 5-8 September 2001

Several events have conspired to demand a rethinking of how we use our rural environments:

- a European-wide restructuring of agriculture and agrarian-related activities;
- the particular impacts on both rural producers and markets of BSE and foot and mouth disease;
- changing attitudes towards, legislation related to, and strong conflicts of interest over rural blood sports;
- simultaneous changing attitudes to, and legislation for changes in access to the countryside;
- increasing individual mobility and penetration of rural areas for both residential and recreational purposes.

It is within these contexts that SAC's second international conference on rural tourism placed an emphasis upon the interrelationships between rural recreational activities and their agrarian context, and the role of tourism within wider processes of rural and regional development. Almost 50 papers and posters were presented*. Those with a more explicit environmental focus included David Botterill and Cliff Nelson's Environmental kite marks and local tourism business performance, based on Welsh experience; David Leslie's Tourism enterprises and environmental performance, based on research carried out in the Lake District; Bill Taylor's Caithness Wildlife Tourism Project, Lesley Roberts and Fiona Simpson's *Encouraging responsible access*, and Richard Sharpley's keynote critique of the governance of sustainability in the light of responses to the foot and mouth crisis.

Two major themes emerged from this gathering of researchers and practitioners:

- that more interchange between the academic world and the managers of, and entrepreneurs within the countryside is critically needed if our rural environments are to be sustained; and
- despite decades of research and practical experience, there is still relatively little known about the demand factors influencing recreational activity in rural areas.

As was the case following the first international conference, an agenda-setting framework for sustainable rural development – The Second Auchincruive Declaration – will be produced as a tangible outcome of this highly successful gathering.

- *The full conference papers are available on a CD-ROM, edited by Morag Mitchell and Irene Kirkpatrick, which is available from Irene, price £35.00 including postage and packing, at The Leisure and Tourism Management Department, SAC, Auchincruive, Ayr KA6 5HW*
Tel: 01292 525056;
Fax: 01292 525055;
Email: I.M.Kirkpatrick@au.sac.ac.uk

Forthcoming conferences and courses

9 November

The Bond Solon Expert Witness Conference
Church House Conference Centre, Westminster
One-day conference looking at the future for expert witnesses.
Details: Bond Solon Training
0800 731 2095

19-23 November

Management Planning in the Countryside
Plas Tan y Bwlch, Wales £308
Short course to train in the art of management planning of sites or species and the production of site and species management plans.
Details: Dewi Jones, Plas Tan y Bwlch, Maentwrog, Blaenau Ffestiniog, Gwynedd, LL41 3YU
01766 590324
Email: dewi.jones@eryri-npa.gov.uk

26-28 November

Health Effects of Vehicle Emissions (and Noise)
Birmingham £325-700
(+£180-300 for noise part)
Three-day international conference on motor vehicle emissions, health effects and emerging solutions.
Details: Frances Webb, PennWell Corporation, PennWell House, Horseshoe Hill, Upshire, Essex EN9 3SR
01628 810562
Email: francesw@pennwell.com

29 November

Healthy Atmosphere, People and Environments
Bristol Zoo
NSCA South West Division and Air Quality Management Centre, UWE Bristol, 4th annual Conference.
Details: Nicky Woodfield, Air Quality Management Resource Centre, UWE, Frenchay Campus, Coldharbour Lane, Bristol, BS16 1QY
0117 344 2929

The Hon. Secretary's news desk…

1. PP4SD

The inter-professional project on sustainable development has moved into a second phase, which will seek to develop from the strong base established in Phase 1 with the completion of the Foundation Training Course. A special two-day event, a 'Train the Trainer' course, was held in July at the Earth Centre, near Doncaster. This marked a transition from the first to the second phase and was attended by representatives of the participating institutions. They will now be in a position to provide an instruction course to members of their institutions.

Details of the training manual and further courses will be appearing on our web site shortly.

2. BA Science Week

The ninth British Association (for the Advancement of Science) Science Week will take place from Friday 8th to Sunday 17th March 2002. Any events to be organised and held during this week can be linked to the BA programme which attracts wide media coverage.

For further information contact the BA at 23 Savile Row, London W1S 2EZ or by email to nationalscience-week@the-ba.net

3. Scottish Regional Group

Interest has been expressed in the possibility of an Institution working group being set up in Scotland as a regional subsidiary of the Environmental Practice Committee. With the significant number of members from SEPA, this should be a viable exercise and a volunteer is already available to help organise this. To 'kick start' this venture it would assist greatly if all members in Scotland who are interested could write to me in the first instance quoting their particular interests. It is expected that a networking system can be developed to overcome distance and travel problems.

4. Responses

Responses have been submitted to the following consultation documents:

- Aims and objectives: New Department (to the Department for Environment, Food and Rural Affairs – DEFRA).
- Framework for Regulations on Local Access Forums (to DEFRA).
- Farming and Food – The Future (to the Policy Commission on the Future of Farming and Food).

5. Nominations for Council

It is now time to make preparations for the elections to Council vacancies in 2002, which will take place at the Annual General Meeting on 6th March. Below you will find a nomination form for membership of Council. All corporate members are eligible to serve and may become candidates once proposed and seconded by two other corporate members.

In order to allow adequate time to prepare voting lists (if necessary) for issue with the AGM papers, all nomination forms must be returned to the Hon. Secretary no later than Friday 7th December 2001.

RAF

Election of members to Council 2002

I ..... **Membership No** .....

(PRINT NAME)

nominate ..... **for election to Council of the Institution of Environmental Sciences.**

Signature *(proposer)* .....

Seconded by ..... **Membership No** .....

(PRINT NAME)

Signature *(seconder)* .....

I ..... **hereby confirm that I am willing to stand for election to Council as proposed.**

To be returned by Friday 7th December 2001 **to:**
The Hon. Secretary, IES, PO Box 16, Bourne, PE10 9FB.

New members

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

Mr D. Barclay	Environmental Protection Officer SEPA
Mr J. C. Y. Chan	Ecotoxicologist ALS Technichem (HK) Pty Ltd
Mr D. Cooper	Hydrologist SEPA
Miss H. E. Cox	Recent Graduate University of the West of England
Mr D. W. Frew	Marine Chemist SEPA
Mr M. P. Jackson	Geo-Environmental Specialist High-Point Rendel Ltd
Dr E. H. John	Postdoctoral Research Officer University of Swansea
Dr J. W. Lancaster	Hydrologist Ove Arup & Partners
Mr A. W. L. MacRobert	Hydrologist Mott MacDonald EPO Ltd.
Mr K. Osborn	Environmental Protection Officer SEPA
Ms K. E. Rinaldi	Environmental Protection Officer SEPA
Mr D. C. Robertson	Environmental Protection Officer SEPA
Mr J. Shakespeare	Waste Services Officer West Berkshire County Council
Mr J. M. Spurway	Marine Scientist/Modeller SEPA
Mr C. Wadsworth	Environmental Safety Officer Warman Intenational Ltd
Mrs F. Wyllie	Chemist SEPA

Diary dates for 2001

31 October	**Education Committee**	**10.30**
	Council	**13.30**
20 November	**GP Committee**	**13.00**

Occasional papers available now from IES

Waste management

- From waste to woods – planting trees on landfill
- From waste to woods: trees on landfill and their place in landscape
- Enhanced landfill strategy
- Waste minimisation: the long term benefits
- European study on EISs of installations for the treatment and disposal of toxic and dangerous waste
- Mercury fall-out from crematoria

Education and training

- Environmental courses undergo a quality assessment
- Student environmental declaration
- On-line information systems in environmental sciences courses
- Global environmental charter and network for students

Business and industry

- The tourism challenge
- The tourism debate and environmental scientists
- Enjoying environmental science as a career
- The Brent Spar and the best practical environmental option

National and local government

- Transport policy, environmental pressures and the new UK government
- Local Agenda 21 – making it work

Price: £5 per paper including p&p
(£3 per paper for members)

Contributors

The *Environmental Scientist* aims to provide a forum for members' contributions, views, interests, activities and news, as well as topical feature articles. Articles up to 3,000 words should be submitted to the Editor, *Environmental Scientist*, PO Box 16, Bourne, PE10 9FB, three weeks prior to publication in the last week of January, March, May, July, September and November.

Views expressed in the journal are those of the authors and do not necessarily reflect IES views or policy.

Advertising

Advertisements should be submitted to reach the Institution by the 7th of the month of publication.
Rates: £50 (half page); £25 (quarter page); £12.50 (eighth page). Full page adverts at £100 can only be accepted under special circumstances, subject to space being available.

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