

Learning curve

Teaching the scientists of tomorrow



by **Kevan M.A. Gartland**
Glasgow Caledonian
University, UK

Responding to climate change

Barriers to progress and green opportunities

Climate change models suggest that Britain's average surface temperature will rise by up to 2.5°C in the coming century, with significant changes in weather pattern¹. We are likely to see drier summers, punctuated with intense rainfall, and flooding and landslides may become more frequent².

In response, Climate Change Programmes (CCPs) have been devised as contributions to attaining Kyoto Protocol targets of a 12.5% reduction in carbon dioxide emissions levels by 2008–2012³.

Responding to the potential effects of climate change requires recognition by individuals, public bodies and others that change is not only necessary but desirable. The recent repeated oil price rises and trebling of wholesale gas prices bring this home to us all, as ever heavier energy bills thud on to doormats.

There are three stages to sustainably changing behaviours: raising awareness of the problem; increasing perception of how to overcome the challenge; and finally, changing behaviours. The latter can be especially difficult when actions undertaken now may not show fruit for several decades.

Barriers to progress provide important challenges and opportunities for green technologies, allowing for effective environmental protec-

tion and sustainable economic growth while safeguarding the future. EU legislation drives businesses towards reducing their emissions and environmental footprint. Increases in energy costs add to this imperative.

Forward-looking businesses are choosing to address the challenges of environmental compliance by developing new green products and services, or by making better use of green materials. Using tax incentives through capital allowances for energy efficient and low-emission equipment and developing appropriate environmental policies emphasizing decreased emissions would also allow businesses to reduce the impact of climate change, while contributing to economic advantage. ASDA, for example, has reduced landfill waste requirements by >35% in the last 3 years.

Public sector organizations face several barriers in dealing with, and adapting to, climate change. Negotiating altered behaviours across organizations can be exceedingly difficult if individuals are sceptical about the effects on their lives. One way in which organizations can react to climate change is by devising appropriate environmental policies, and even require similar climate change policies of their suppliers and partners.

Many of the changes in behaviour involved in implementing environmental policies are individually small, but can together contribute to a greater whole, reflecting the slogan 'Do a little, change a lot'. While adopting this approach is initially challenging, the benefits can readily cascade to hundreds of organizations and related businesses in a relatively short time. Organizations without supplier and partner environmental policy requirements are likely to find themselves at a competitive disadvantage against early adopters. The challenge for these organizations is to catch up with greener bodies or even overtake them.

Adapting to the early effects of climate change in order to minimize future consequences is a challenge for each and every one of us in our daily personal and professional lives. Adaptations include reducing emissions by using cleaner technologies, favouring renewable energy sources over fossil fuels and carefully considering transport policies, individually and collectively. Legislative instruments may soon demand this of us all.

Dealing with the increased likelihood of intensive rainfall events, landslides and flooding will require greater expenditure on flood defences



and erosion control. Currently, responsibility for erosion control rests with landowners, but this is one policy which may have to be revisited.

What effects might be seen as Britain becomes up to 2.5°C warmer, with wetter winters and drier summers and up to 40% less rainfall as a whole? Patterns of tourism will undoubtedly change; winter sports industries will be under pressure as snowcover may decline by up to 60% and the leisure hill-walking season could be extended as significant snows arrive later each winter.

Adaptation will undoubtedly affect agriculture and biodiversity, as the accessible range for plant and animal species is predicted to move northwards by up to 300 km for each 1°C warming.

The challenge here is to identify which species are most under threat and devise achievable preservation projects for them, without an excessive degree of environmental interference. Scottish Natural Heritage has recently published evidence for earlier flowering of many plants, affecting food availability for birds, due to rising temperatures.

Habitat alterations will also bring new and exotic pathogens, as warmer, wetter winters and hotter, drier summers become the norm for much of Britain. Pathogen movements risk being too swift for the co-evolution of resistance among susceptible species, leading to undesirable effects and ecological imbalances.

Human health too will be affected by climate change, with increased instances of heat-related illness, greater persistence of bacterial pathogens previously killed off by winter cold and the arrival of exotic human pathogens, such as episodic malaria. The health and care services will face new challenges, such as the fatal effects of severe

overheating on the elderly, as experienced in France during the summer of 2003.

Rendering as many as possible of our activities carbon-neutral is a major challenge. Scotland has made valiant progress towards increasing the use of renewable energy, anticipated to exceed 18% of energy needs by 2010. However, the rest of the UK lags behind.

Discouraging the unnecessary use of fossil fuels by increasing the climate change levy and by promoting energy efficiency is a key factor in reducing emissions.

Hydrogen-based energy provides one way to reduce fossil fuel dependence, but there are a number of barriers to it being adopted. Plants, of course, already take advantage of this through photosynthesis, as recently pointed out by Jim Barber⁴ in *The Biochemist*.

Public perception of hydrogen-based fuel sources is often unfavourable — H is for Hindenburg as well as for hydrogen, after all. This barrier will be difficult to overcome until hydrogen-powered vehicles become much more commonplace. The capital cost of hydrogen fuel-cells and their short lives are additional barriers to widespread use. Public education can overcome reluctance to consider hydrogen as a safe green fuel.

Climate change and high oil prices mean the future looks bright for biomass crops. Increasing use of biomass-derived fuels is an important target for the sustainable management of forests. Ensuring stability of supply and local processing capacity to limit transport miles and the identification of new biomass crops are key challenges for the biomass industry, while new opportunities will arise from enhancing the calorific efficiency of local heating

systems, increasing use of bioethanol as a fuel and utilizing domestic and business waste as a feedstock for energy recovery facilities.

The growth and processing of biomass crops can give an additional stimulus to the rural economy. Devising novel green technologies, such as processing vegetable oils as diesel substitutes, is a positive way in which fossil fuel dependence can be reduced, especially if promoted to the consumer as a way to decrease transport costs.

Publicizing more of these green win+win situations is needed if long-term behaviours are to be changed. A crucial challenge facing green groups and organizations in mitigating climate change is the need for simple, clear messages to be put across to the public. Media exposure for the climate change cause will not last if the messages become too complex, or too much background information is conveyed to the audience. In this regard the 'Do a little, change a lot' message is both useful and effective.

Dealing with climate change is an opportunity for both public and private sectors to work together to develop innovative technologies, greener products and services while delivering sustainable economic advantage, to protect the environment and quality of life for ourselves and future generations.

References

1. United Kingdom Climate Impact Programme (UKCIP02) (2002) Climate Change Scenarios for the UK
2. Natural Environment Research Council (NERC) (2004) Climate Change Information Bulletin
3. Scottish Climate Change Programme (SCCP) (2000) Making it work together. Scottish Executive 2000/208
4. Barber, J. (2006) *The Biochemist* 28 (4), 7–11
5. www.ace.abertay.ac.uk