

Pay now, save later – will the Stern review mark a turning point in attitudes to climate change?

THE WORLD faces a depression-era economic slump if immediate action is not taken by the globe's largest emitters of greenhouse gases, warned the former chief economist of the world bank, Sir Nicholas Stern, in a 700-page tome, published on 30 October.

The Stern review, the most comprehensive analysis of the economics of climate change ever undertaken, was the result of a year-long study that included interviews and submissions from dozens of NERC researchers and academics, including NERC's chief executive, Alan Thorpe, and director of Science and Innovation, Steven Wilson. Alan said, 'The report emphasises the continuing critical need for science to provide the solid foundation for determining action on climate change – this means a fully multidisciplinary approach across the natural, social and economic sciences.'

'This is where NERC is going to take a leading role over the next few years,' he added.

Alan highlighted that policy

makers require a much greater degree of scientific certainty than we have now on the regional and shorter timescale signals, and this must be a focus of NERC-funded science in the future.

'Many of the impacts of climate change on, for example, biodiversity, human health, air and water quality still have huge scientific uncertainties associated with them,' he went on to say.

The NERC-funded Tyndall Centre For Climate Change Research made a substantial contribution to the report, described by Tony Blair as the most important published by his government, including four commissioned analyses and the year-long secondment of Simon Dietz (funded by the Economic and Social Research Council) – the first time a scientist has been placed at the Treasury.

Tyndall director, Mike Hulme, said, 'Too many debates about climate change policy rely on partial or inappropriate economic analyses. The Stern report offers the prospect of a better informed and more transparent debate about how economics can inform national and international climate policy making.'

NERC's National Centre for



Atmospheric Science, hosted a climate change workshop for members of the Stern team. Their involvement also included providing information on potential changes in the Indian summer monsoon and impacts on food production, as well as general information on climate forcings and climate impacts.

The key economic finding from the report is that 'if we don't act, the overall costs and risks of climate change will be equivalent to losing at least five percent of global GDP each year, now and forever. If a wider range

of risks and impacts is taken into account, the estimates of damage could rise to 20 percent of GDP or more.'

In contrast, the report says that the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around one percent of global GDP each year.

Full report: www.hm-treasury.gov.uk under 'independent reviews'.

See Chief Executive's editorial p1.

Atmospheric scientists tie knot with insurance companies

HURRICANE KATRINA was a wake-up call to the insurance industry. The industry has now hooked up with atmospheric scientists to create the largest ever collaboration between the

academic and financial communities.

Scientists at the National Centre for Atmospheric Science and other university groups, including the universities of

Reading and Exeter, will provide predictions, advice and probability analyses of the future occurrence of natural catastrophes such as hurricanes, storms and flooding. In addition,

insurance brokers, the Willis Group, have agreed to fund a three-year university research post in this area, starting in 2007. Contact: Louisa Watts, NCAScomms@nerc.ac.uk



Birds do it, bees do it, but how much energy do they expend?

RESEARCHERS have found a new cheap and easy way to work out how much energy wild animals expend in their daily lives: foraging, flying, jumping, running and even copulating. Ecologists have long appreciated the value of understanding allocations of energy reserves to those behaviours because survival rests on the careful use of energy, but until now a simple way of determining the amount of energy has eluded them.

Ornithologists from the universities of Swansea and Birmingham have adapted a piece of waist-mounted equipment used by physiologists to measure gait and movement in humans, known as an accelerometer, to measure body

motion and thus estimate energetic costs in great cormorants as they walk, fly and dive underwater.

Lewis Halsey from the University of Birmingham said, 'The findings are clearly promising, but the big issue is this: could accelerometry be applied to answer questions about the field energetics of any species? If the technique proves successful for a diverse range of species, ecologists may finally have a tractable, inexpensive method for quantifying the energetic challenges faced by many wild animals.'

In 2007 the team will test accelerometry on Tamar wallabies. Contact: l.g.halsey@bham.ac.uk

Winter sea ice forming on Greenland's east coast



17 October 2006



30 October 2006 Scoresby Sound, East Greenland

Satellite images processed by NERC's Dundee Satellite Receiving Station show sea ice rapidly forming as winter approaches. Ocean currents cause the complex swirling patterns.

Climate change blamed for deadly disease in Spanish frogs

SCIENTISTS have discovered a correlation between climate change and the emergence of a fungal disease that attacks amphibians, *Batrachochytrium dendrobatidis* (BD), according to the journal *Proceedings of the Royal Society B*, 18 October. The fungus infects amphibians' skin and causes high mortality in many species. The common midwife toad is now virtually extinct in the

area of Spain studied.

The researchers say it is likely that increases in the number of BD-related mass mortalities are due to a combination of factors relating to climate change. As amphibians are cold-blooded, their body temperature is linked to the surrounding environment, meaning that changes in external temperature may affect their bodies' ability to

respond to disease.

The researchers also believe that BD may be better able to thrive in warmer conditions, with milder winters allowing it to survive and grow throughout the year.

Matthew Fisher, from the Department of Infectious Disease Epidemiology, at Imperial College London, and one of the authors of the paper, said, 'You can't overstate how

serious this pathogen is – it is the worst infectious disease ever recorded among vertebrates in terms of the number of species affected, and its propensity to drive them to extinction.

'Our finding that warming climates are linked to changing patterns of disease in Spain has broad implications for the survival of amphibians across Europe,' he added.

Scientists and technicians deploy and recover the rapid array. The yellow buoy provides buoyancy to instruments in the water below.



Rapid climate change array produces first results

THE RAPID climate change array, a series of scientific instruments spread out across the Atlantic between Africa and the United States to measure the Atlantic's massive overturning circulation, is working successfully, Harry Bryden announced at NERC's Rapid Climate Change International Science Conference held in Birmingham, 24-27 October.

The first results from the 25 moorings, which form part of NERC's £20 million Rapid Climate Change programme, correlate closely with the hydrographic measurements the team took shortly after deploying the first moorings in 2004.

'The first measurements are the traditional way of monitoring the circulation in the Atlantic,' said Harry.

'We took one last measure-

ment in 2004 to see what a traditional estimate of the overturning circulation looked like, to compare with the array,' added the National Oceanography Centre, Southampton, scientist.

This section formed the basis of Harry's paper published in *Nature* (November 2005) which showed that the circulation largely responsible for Europe's temperate climate slowed by about 30 percent between 1992 and 2004.

The first results from the array show a slowdown. 'In 2004 the Atlantic circulation was more circulating and less overturning than we had seen in the previous sections,' Harry told the conference. Some of this, however, could be due to natural variability, of which very little is known.

This pilot scheme could pave the way for a permanent

monitoring system that will greatly improve knowledge of how water moves around the Atlantic, as well as providing an early warning system of any major changes.

The array has already produced some unexpected results including an abrupt halt of part of the current in November 2004.

'There was one remarkable event in November 2004 when the flow of North Atlantic deep water halted. The three-degree isotherm descended 700 metres creating a shear so the current stopped. We'd never seen anything like that before,' said Harry.

The government's chief scientific advisor, Sir David King, gave the keynote address to the conference. The abridged speech is available online: www.nerc.ac.uk/press/features/2006/rapid-conference

For full details of the conference proceedings: www.noc.soton.ac.uk/rapid/rapid2006/

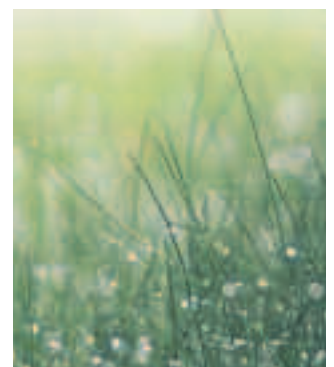
Green plants attract rainfall

RAINFALL increases by 10-30 percent when the land is green, and decreases by a similar amount when conditions are dry and there is little green vegetation growing, according to scientists from NERC's Climate and Land Surface Interactions Centre (CLASSIC) studying African rainfall patterns.

The team, who studied 18 years of satellite records, found that rains at the start of the growing season cause vegetation growth, encouraging a feedback loop as the greener the vegetation becomes, the greater the amount of rain that falls.

Sietse Los, programme manager of CLASSIC, said, 'The role of vegetation in enhancing both wet and dry conditions in sub-Saharan Africa is important for understanding the causes of droughts, which often have dire consequences for the local population. Our research will help to improve current climate models and give better rainfall and vegetation growth predictions. And in turn this will help both climate scientists and local agricultural managers.'

The paper 'An observation-based estimate of the strength of rainfall-vegetation interactions in the Sahel' was published in *Geophysical Research Letters*, 33, L16402, doi:10.1029/2006GL027065. <http://classic.nerc.ac.uk/>



Environmental science boosts UK economy

ENVIRONMENTAL science is worth hundreds of millions of pounds to the UK economy according to a recently published independent study. The study, a first for a research council, examined the benefits to the UK from NERC-funded research.

The report highlights a number of programmes, including the Centre for Ecology & Hydrology's Flood Estimation Handbook which it conservatively estimates is worth £7-34 million to the UK economy, and the British Geological Survey's ground instability data used by insurers, developers and planning authorities, which is estimated to be worth £70-270 million.

Other highlights include a £20 million saving gained from using NERC science to reduce the cost of gritting and salting icy roads, and a potential £200-1100 million benefit to the economy if Britain capitalises on the fast-growing marine biotechnology industry.

The government's chief scientific advisor, Sir David King, said, 'I am very glad this analysis has taken place. One of the most difficult messages to get across at any level is where you have avoided risk or if you have significantly reduced risk. The whole issue around global warming is one of preparing our societies for the impacts of climate change. What is the economic value of avoiding those impacts – massive.'

A full report is available to download at www.nerc.ac.uk. For more information on the economic benefits of NERC science contact Richard Blackmore, rwlb@nerc.ac.uk.

The economics of healthy eating and land use

IF EVERYONE in the UK ate a healthy diet, consumption of fruit, vegetables, bread and fish would have to increase by 40-50 percent, according to scientists on the Rural Economy and Land Use research project (RELU).

Biggest losers in the study would be the cheese-makers with consumption plummeting by 75 percent. Sweet and soft drinks consumption would fall by 30-35 percent, fats (vegetable oils, butter and margarine) by about 20 percent, and the meat industry

would face a 15 percent slump in trade.

Scotland and Northern Ireland have the biggest hill to climb. Fresh vegetable intake would need to double while cut-backs in soft drinks, confectionery, sugar and cheese would be sharper than in England or Wales.

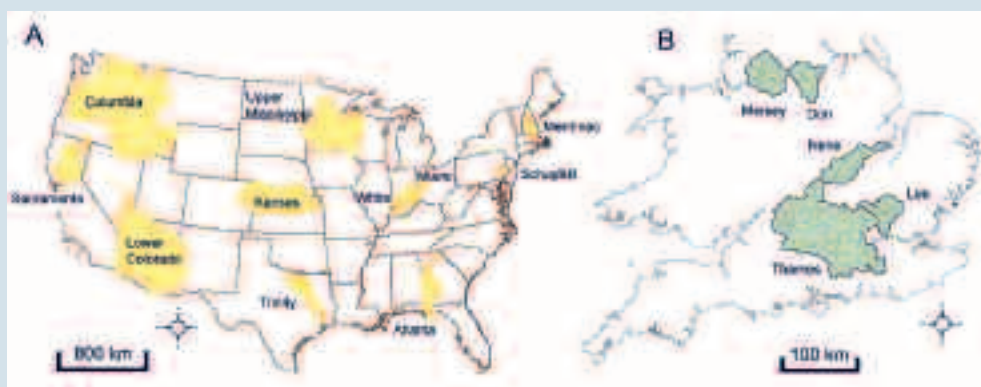
The research not only shows how much change in overall consumption is implied by healthy eating recommendations, but also helps researchers to understand and assess how much agriculture and land use

would need to adjust.

Bruce Traill, at the University of Reading, said, 'We know in general terms that we should eat more fruit and vegetables, limit fat and sugar intake and restrict total energy intake so as not to put on weight, but often we don't know how much we should adjust our own diets, let alone how much the country as a whole needs to adjust.'

The study was part of the RELU project '*Implications of a nutrition-driven food policy for land use and the rural environment.*'

Study highlights the risks of pandemic drug



Catchments within the US and UK where scientists modelled river water Tamiflu concentrations during a simulated influenza pandemic.

TAMIFLU, the antiviral flu drug recommended worldwide for the prevention and treatment of avian flu in humans, could cause serious environmental pollution as well as encouraging a new strain of virus to develop if widely used.

Reporting in *Environmental Health Perspectives*, researchers at the Centre for Ecology & Hydrology describe the likely effects of widespread antiviral treatment for a flu pandemic on wildlife and the natural environment.

Lead researcher Andrew

Singer said 'An antiviral drug has never been widely used before so we need to determine what might happen. During a flu pandemic, millions of people will all take Tamiflu at the same time. Over just eight or nine weeks, massive amounts of the drug will be expelled in sewage and find its way into the rivers. It could have huge effects on the fish and other wildlife.'

'The build-up of Tamiflu in rivers is likely to cause the avian influenza virus in wildfowl to become resistant to it, potentially resulting in a new wave of flu

that is unaffected by the Tamiflu drug or similar antivirals. People in South-east Asia, for example, could be more at risk from contracting the new strain of influenza because they have close and frequent contact with wildfowl,' he added.

The paper 'Potential risks associated with the proposed widespread use of Tamiflu' was published online, 11 October, 2006 in *Environ.* www.ehponline.org/docs/2006/9574/abstract.html



700,000-year-old stone tools under the microscope

A SMALL handful of ancient stone tools, which represent the earliest existing evidence of human activity in the UK and northern Europe, are under close scrutiny by NERC PhD student Adrian Evans and colleagues at the University of Bradford. The 700,000-year-old tools, discovered in Pakefield, Suffolk, in 2005, predate previously discovered artefacts found in the UK by 200,000 years.

Adrian said, 'We will see if we can find evidence to suggest they were used as tools for activities such as stripping meat

and skins from the carcasses of animals, or sharpening spears for hunting.

'What we're actually looking for is how the stones might have been modified by humans and by nature in the burial environment after they were discarded. One of the samples has a rounded bulbous end to it, and this was probably used as a hammer. Other pieces have very sharp edges which have been retouched suggesting they too have been modified for use.'

Contact:
A.A.Evans@Bradford.ac.uk

Adrian Evans and his stone tools.

Embryos show ancient life was capable of complex cell division

THE FIRST direct evidence that 560 million years ago primitive animals were capable of cell division that was asynchronous – not at the same time - during embryonic development, has been found by scientists at the University of Bristol and colleagues in the US, China, Sweden, Switzerland and Australia. Asynchronous cell division allows the formation of unique shapes.

Phil Donoghue at Bristol said, 'Using a method of tomography to look inside the embryos of this sponge-like animal we could count all the cells. We didn't get the number we were expecting, which was very surprising and, evolutionary speaking, this was telling us something.'

'The ancestors of all animals arose from a type of organism similar to these creatures,' he added.

The fossilised embryos, found in China and predating the Cambrian Explosion by tens of millions of years, show that early animals had already begun to adopt some of the structures and processes seen in today's embryos. The Cambrian period was a dramatic time in the history of life on this planet when it seems animals first emerged and quickly became more diverse and ecologically dominant.

'Nobody has done this before,' explained Phil. 'These new techniques we're developing will tell us a great deal about the evolution of embryos but we think we can also use the techniques to study the evolution of other structures including the evolution of the vertebrate brain.'

'Cellular and subcellular structure of neoproterozoic animal embryos', *Science*, vol.314, no.5796.

A new analysis predicts collapse of fish stocks by 2050



'MARINE biodiversity loss is increasingly impairing the ocean's capacity to provide food, maintain water quality, and recover from perturbations.' This is the hard-hitting conclusion of a report in the American journal *Science*, 3 November, that predicts, with current rates of diversity loss, there will be no more viable fish or invertebrate species available to fisheries by 2050.

One of the report's authors, Nicola Beaumont from Plymouth Marine laboratory, said, 'Marine biodiversity provides lots of services to the planet besides fisheries – such as preventing algal blooms, processing waste and maintaining the ability of the oceans to absorb our carbon dioxide emissions.'

'To help minimise climate change we need a resilient and healthy marine ecosystem,' she added.

The study quantifies how the loss of marine diversity on local, regional, and global scales has affected the functioning and stability of marine ecosystems, the flow of ecosystem services, and the rise of associated risks to humanity.

'Impacts of Biodiversity Loss on Ocean Ecosystem Services' *Science* Vol. 314. no. 5800, pp. 787-790.

Diary

January**Association of Science Education**

4-6 January 2007

University of Birmingham.
Teachers' conference.

NERC-funded scientists Jim Smith and David Howard will talk on 'Is nuclear power sustainable?' and 'energy use'.

Atmospheric end of programme event

23 January 2007

Institute of Physics, London.
Join us in London to find out the latest from four of NERC's research programmes.
Register online by 12 January.**NERC open meeting**

31 January, 6-8pm

Institute of Physics, London.
Join us to discuss the new NERC strategy**February****Ocean Margin LINK end of programme event**

15 February 2007

Royal Society, London.

International Polar Year Launch event

26 February 2007

(to be confirmed)

Royal Society, London.

March**National science week**

9-18 March 2007

www.the-ba.net/theba/Events/NSEW**April****Environmental Genomics end of programme event**

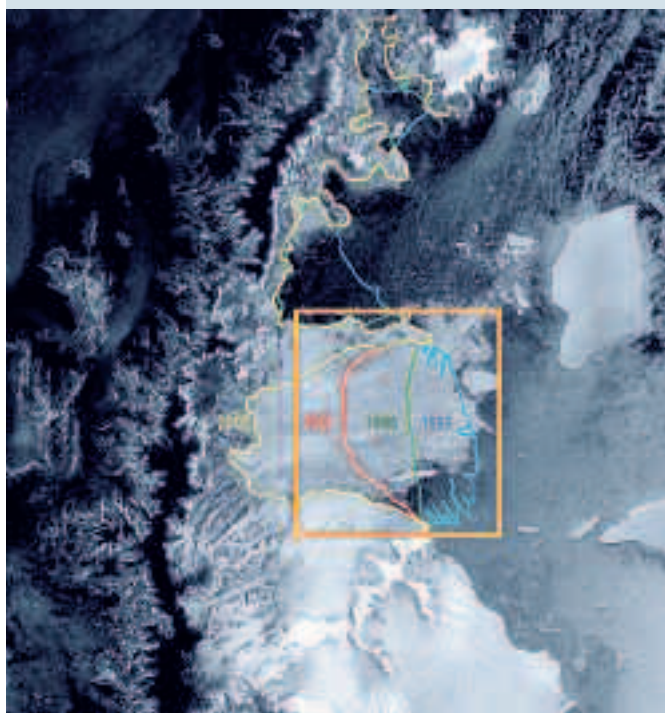
16 April 2007

Church House, London.

International Polar Year parliamentary event

Date to be confirmed.

Industrial emissions linked to ice shelf collapse



NEW Antarctic weather patterns, caused by climate change, are responsible for the collapse of ice shelves in Antarctica according to scientists in the *Journal of Climate*, 15 October.

Scientists from the British

Antarctic Survey (BAS), the Centre for Polar Observation and Modelling, and the Katholieke Universiteit Leuven, Belgium, have discovered that stronger westerly winds in the northern Antarctic Peninsula, which several previous studies have demonstrated are

driven principally by human-induced climate change, are responsible for the marked regional summer warming that led to the retreat and collapse of the 3320km² Larsen B ice shelf in 2002.

Global warming and the ozone hole have changed Antarctic weather patterns, creating stronger westerly winds that force warm air eastward over the natural barrier created by the Antarctic Peninsula's two-kilometre-high mountain chain. On days when this happens summer temperatures in the north-east peninsula warm by around five degrees Celsius, creating the conditions that allowed melt-water to drain into crevasses on the Larsen ice shelf, a key process that led to its break-up.

Lead author Gareth Marshall from BAS said, 'This is the first time that anyone has been able to demonstrate a physical process directly linking the break-up of the Larsen ice shelf to human activity.'

Research confirms glacier's potential instability

ANTARCTIC scientists have mapped the ground beneath the Pine Island Glacier to improve stability predictions of the West Antarctic Ice Sheet. David Vaughan from the British Antarctic Survey (BAS) explained, 'Predictions about future changes here have been hampered by our poor knowledge of the terrain beneath the glacier.'

'Our airborne survey has allowed us to build a good picture of the terrain. The trunk of this glacier lies in a narrow trough, suggesting a long-lived and constrained ice stream. The lower basin of the glacier is surrounded by bedrock,

which if the ice melted would lift up and rise above sea level,' he added.

The work confirms potential instability of the lower basin, which contains sufficient ice to raise global sea levels by around 24 centimetres.

In another paper published in the *Journal of Glaciology* BAS scientists explain how a new radar technique they have developed is giving them a clearer view of ice behaviour.

Using phase-sensitive radar - an exceptionally accurate version of the systems used by ships and aircraft - Adrian Jenkins and colleagues

studied the internal structure of the enormous Filchner-Ronne Ice Shelf, as well as the rate at which the bottom of the ice shelf is melting.

Adrian said, 'Internal structures are formed as layers of snow are laid down each year. These layers produce radar reflections that give us a totally new view of the internal workings of an ice sheet. This will help us understand how the ice flows and improve our ability to predict how the ice sheet as a whole will evolve in the future, which is important because growth or shrinkage of the ice sheet has a direct impact on global sea level.'