

New Research  
Strategy 2006-2009  
pages 18 and 19

Tyndall°Centre  
for Climate Change Research

# the effect

2006

Highlighting research and communication at the UK's Tyndall Centre



Carbon dioxide emissions must go to zero to allow for aviation

Hurricane survival guide for overseas territories

Communities want more say in shoreline management plans

Sea level rise may boost some beaches



Public perceptions of nuclear power and renewable energy

Hollywood does not influence climate change behaviour

Carbon cost of \$150 needed to stimulate low-carbon innovation

...researching sustainable responses to climate change



# Researching sustainable responses to climate change

Founded in 2000 and led by the University of East Anglia, the UK's Tyndall Centre for Climate Change Research fuses traditionally separate disciplines from across leading UK universities into a single coherent research organisation. Bringing climate change research to bear on decision-making, we bring together climatologists, social scientists, economists, policy analysts, engineers and natural scientists into seven

global-to-local research programmes. The Centre is core-funded by the Natural Environment, the Engineering and Physical Sciences, and the Economic and Social Research Councils.

Named after John Tyndall, the discoverer of the greenhouse effect and successor of Michael Faraday as Director of the Royal Institution of Great Britain, the

Tyndall Centre aims to be academically strong, socially relevant, and an active communicator of science. We are always very pleased to respond to suggestions for initiatives the Tyndall Centre should take; please contact Asher Minns (the Communication Manager) with your ideas [a.minns@uea.ac.uk](mailto:a.minns@uea.ac.uk)  
tel: +44 (0) 01865 275867



Photographs on cover:  
Ashley Sampson, Henry Osbahr,  
© Joerg Boethling/Still Pictures,



# The Director's View

Welcome to the 2006 edition of the effect, the Tyndall Centre's annual magazine. It is in fact two years since the last issue ... in July 2005 we instead published Key 8 for G8, a summary of eight discoveries made by the Centre that we wished to enter public discourse around the time of the G8 Summit in Gleneagles. During these last two years the Centre has also had to invest a considerable amount of intellectual and emotional energy into securing a renewal of its baseline funding contract from the three UK Research Councils – NERC, EPSRC and ESRC. That we have eventually succeeded, at least out to 2009, reflects on the determination and self-belief of the researchers, support staff and university Faculty who comprise the 75 or so people who have made the Tyndall Centre the success it has become.

The last two years have also seen a significant change in the tone of the debate about climate change, at least in the UK if not always elsewhere. In public discourse there is now often a distinction made between 'climate change' and 'catastrophic climate change', as though these are two quite different phenomena or as though two different belief systems are implied. The frequent insertion of the qualifying adjective 'catastrophic' now arises I think for two reasons – new scientific research about irreversible thresholds in the Earth system

(which some interpret as catastrophic); and a new aggressiveness in climate change campaigning which laments the lack of measurable progress in reducing greenhouse gas emissions.

Against this changing backdrop, the Tyndall Centre's mandate and mission remains to undertake research, from a range of inter-disciplinary perspectives, which will help society develop and implement sustainable responses to climate change. To make such research effective we need to understand this changing public discourse, as well as the changing geopolitics of the international climate change negotiating process. We have to listen carefully to a wide range of stakeholder voices and concerns. Yet we must also remain rooted in the various knowledge communities so that we can create, shape and translate the intellectual insights about the phenomenon of climate change against which all sustainable actions must in the end be tested.

The stories of the Centre's work and activities told in this issue of the effect will I am sure convince you of the breadth

**“that we have succeeded, reflects on the determination and self-belief of the researchers, support staff and university Faculty”**



*Professor Mike Hulme of UEA is the Founding Director of the Tyndall Centre*

and relevance of this endeavour. I would encourage you to get in touch with us – through our web site or headquarters office – if you wish to find out more about these stories or to explore ways of working with the Centre in the future.

Professor Mike Hulme  
UEA Norwich, 2006

*The Tyndall Centre has a long-standing interest in working with threatened coastal communities in the East of England, wider UK, and the British Overseas Territories'*



*Decarbonising the UK, led by Tyndall Manchester, is the UK's first comprehensive roadmap to how the UK can achieve its climate change targets across all sectors of the economy*



# Everyone's carbon dioxide emissions must go to zero to allow for aviation

All householders, motorists and businesses will have to reduce their net carbon dioxide pollution to zero if the growing aviation industry is to be incorporated into Government climate change targets for 2050 revealed new research that was launched by Tyndall in September 2005. The report shows that even if aviation's current growth is halved from today's level, the rest of the economy will require carbon dioxide cuts far beyond UK Government targets.

"If the UK Government does not curb aviation growth, all other sectors of the economy will eventually be forced to become carbon neutral. It could undermine the international competitiveness of all UK industry, except airlines", says Dr Kevin Anderson who led the research at the Tyndall Centre at Manchester University. The Government's Aviation White Paper predicts that UK passenger numbers will more than double from 180 million to 475 million over the next 25 years.

These new findings are part of a five year comprehensive study by Tyndall that sets-out a far reaching agenda for cutting

carbon dioxide emissions over the next 45 years by detailing the actions that need to be taken by Government and industry. The report, called *Decarbonising the UK*, describes pathways for cutting carbon dioxide emissions from road transport, housing, industry and coal-fired power stations; and the role of renewable energy, nuclear power and hydrogen fuel in providing low-carbon energy supply. The report also considers the potential of policy instruments to cut carbon dioxide, such as the newly proposed scheme of citizen's carbon permits.

Though *Decarbonising the UK* led with an aviation headline, there is substantially more to it than an analysis of aviation growth. It is the first in-depth study to combine carbon dioxide emissions from the UK's energy infrastructure, buildings and industry with those from air, sea and land transport. It is unique in incorporating the different perspectives of energy analysts, engineers, economists and social and environmental scientists into a wide understanding of the whole UK energy system. The main conclusions include:

- Improvements in energy efficiency can dramatically decarbonise many sectors
- Policies for reducing energy demand are a more flexible tool than implementing low-carbon supplies
- Supplying low-carbon energy is both technically and economically viable
- A society with high energy demand will face future infrastructural challenges in providing secure energy
- A low-carbon society does not necessarily preclude increases in personal travel
- Government must implement and enforce minimum energy standards
- Allocating carbon fairly between the rich and poor needs innovative policies and mechanisms
- All sectors must be included in any carbon-reduction strategy
- International aviation and marine emissions must be included in national carbon reduction targets

## Further information

[tyndall@manchester.ac.uk](mailto:tyndall@manchester.ac.uk) or

**Tyndall Technical Report 33**

# Water shortages threaten irrigated farming

There is a clear risk of major restrictions on crop irrigation because of the changing climate concludes a study of agricultural river catchments in the East of England led by Keith Weatherhead at Cranfield University. For all the UK climate change scenarios considered, groundwater recharge will be substantially reduced, summer river flows fall considerably, and winter river flows also fall despite higher winter rainfall.

“These changes imply major reductions in the water available for abstraction and its reliability” says Keith. “Farm irrigation would have the lowest priority for taking available water and would be impacted first, either through water restrictions already set in abstraction licences or new rules in the future”.

## “most farmers are aware of climate change but are focussed on shorter-term issues, due to the financial uncertainty in agriculture”

By the year 2050 yields of a wide range of crops become significantly adversely affected with a high emissions scenario. Average summer temperatures in the South of England could then be 3 to 3.5 degrees higher than now, and summer rainfall 30 to 40% less. It is unlikely that sugar beet or potato could be produced on light soils without irrigation. One unknown is the fertilisation impact of higher carbon dioxide levels. It is long established that plants grow better in elevated carbon dioxide levels but large-scale field experiments on vegetables and potatoes are lacking.

The study modelled how farmers might react. The researchers allowed for uncertainty and variability in farmers’

A Cranfield University led study within Tyndall shows that most farmers believe that they can adapt to climate change and future water shortages



© Joerg Boehning/Still Pictures

decision-making for a more sophisticated and complex real-world understanding. The results indicated that cropping patterns will be changed, low value crops will be irrigated less, and some farmers will want to build new reservoirs, filled from winter abstraction. However, the risk of low river flows in the winter suggests a limitation to this last strategy, currently an option preferred by government

agriculture. Not all believe in the forecasts. Most believe that they can adapt to climate change later as necessary” says Keith, “though they may be underestimating the water resource issues.”

“We only looked at two catchments, to develop our new framework of understanding, but in formulating adaptation advice for farmers it is also

agencies. These modelled results were consistent with the findings of interviews with farmers.

Farmers were asked about how they had adapted to water scarcity in the past and their attitudes to the future. Most believed that they had a range of coping strategies and longer term options, but did not think that there is substantial scope for increasing their water efficiency. Higher efficiency is presently one of the main targets of the government agency that regulates water abstraction.

“Most farmers are aware of climate change but are focussed on shorter-term issues, due to the financial uncertainty in

important to consider climate change impacts on market competition from abroad” he warns. Follow-on research is now looking at the range of water adaptations available for growers and farmers in the Vale of Evesham.

The project team comprised seven research organisations, with Universities at Cranfield, Nottingham, Southampton and East Anglia, the Stockholm Environment Institute in Oxford, and agricultural researchers at ADAS.

### **i** Further information

k.weatherhead@cranfield.ac.uk or  
Tyndall Technical Report **44**



# The world in 3000 could be warmer than for the past 55 million years

*Tyndall's 1000 year climate change scenarios use a new modelling system that takes days of free computing rather than many months of super-computer*

"If we could see climate change from an Earth-system perspective, a thousand years would seem but a blink in the eye for geological time" says Dr Tim Lenton at the University of East Anglia, discussing his climate change scenarios to the year 3000. He believes that most projections of future climate change end at 2100 because we have trouble contemplating the world after we cease to live in it. "It might seem like folly to predict humanity beyond 2100, but not looking may be a greater folly than not trying".

Tim invokes Earth-system logic for why we should realise that a century is too short to understand the climate consequences of our actions today. "Graphs to the year 2100 typically leave global temperatures or sea level rising off the page". Changes in atmosphere and changes in ocean circulation are more likely to re-balance around the millennial than century timescale. Slower is the thermal expansion of sea water, the melting of ice sheets and the consequences for sea level rise. Even slower is the neutralisation of ocean acidification.

Tim's millennial models, done in a partnership with the UK's Environment Agency, predict a global warming of 1.2 to

## Changes in atmosphere and ocean circulation are more likely to re-balance around the millennial than century timescale

15.6 degrees Celsius over the next 1000 years. The maximum warming is four times more than the 0.9° to 3.7°C predicted by the end of this century, and more than doubles the 1.4° to 5.8°C by 2100 of the Intergovernmental Panel of Climate Change. For the UK, the millennial scenarios show a warming between 1.2° and 10°C over the next 1000 years. For comparison, the scenarios of the UK Climate Impacts Programme show a warming by 2100 between 1° and 5°C. Tim used a new modelling system that takes days of free computing power, rather than many months on expensive super-computers.

He shows that sea level will still be rising in 3000. If all reserves of known and unconventional fossil fuels are burned-up, sea level will have risen 11.4 metres by the

next millennium. The same scenario shows an abrupt change in the North Atlantic circulation long after emissions cease.


Over the millennium, the ocean becomes a less effective carbon sink the more the emissions of carbon dioxide, and the land a carbon source. Overall, the models show that total emissions are the controller of millennial climate change, but the rate of emissions controls the speed of the changes and to an extent whether an abrupt climate change occurs.

"Only the minimum emissions scenarios – a deep green future - can prevent global temperatures from rising more than 2°C relative to before the start of our coal and oil age. If we exploit the unconventional fossil fuels, then the world could be warmer within 1000 years than it has been for the past 55 million".

### **i** Further information

t.lenton@uea.ac.uk and

**Tyndall Technical Report 41**



# The British public is increasing its acceptance of nuclear power but overwhelmingly prefers other energy options

In January 2006, the week before the Government began its consultation on the future of UK energy, an extensive survey by UEA of the British public's attitudes towards future energy options showed that just over 50 per cent may be prepared to accept new nuclear power stations if it would help to tackle climate change. But few people actively preferred the nuclear option over alternatives such as renewable sources and greater energy efficiency. Most people believed that promoting renewable energy sources (78 per cent), and reducing energy use through lifestyle changes and energy efficiency (76 per cent) are better ways of tackling climate change than nuclear power.

The detailed survey was released in January 2006 and was carried out jointly by researchers at the University of East Anglia from the Centre for Environmental Risk and the Tyndall Centre, in conjunction with Ipsos MORI, with part-funding from the Leverhulme Trust, the Tyndall Centre and the ESRC.

The Government's energy review considered whether the nation needs to replace its ageing nuclear power stations with new-build as one contribution towards its climate change objectives. Polls over the past four years have shown a gradual lessening of opposition to replacing nuclear power stations; these new results still show more opposition than support. This work helps to understand public opinions of the nuclear power and climate change debate.

Professor Nick Pidgeon, who led the survey research team, explained: "The survey findings suggest that, given the numbers who are still opposed to renewal of nuclear power, there remains considerable potential for conflict around this issue. Additionally, many of those who do accept new nuclear power for Britain do so only reluctantly, and only if renewables and other strategies are developed and used alongside. Ordinary people have a more sophisticated understanding of energy futures than many decision makers like to believe. This wider context is something which the government

should take very seriously during its own energy review."

The findings of the Government's Energy Review were released in July 2006. Kevin Anderson who leads Tyndall's energy research from Manchester University said at the time: "It is an electricity review that ignores the big issues of UK energy and global climate change, neglecting the other 82 per cent of UK energy use. Electricity provides just 18 per cent of the UK's final energy consumption, with nuclear providing only 3.6 per cent of UK energy. Consequently, replacing ageing nuclear plant with new nuclear power stations has an all but irrelevant impact on targets for reducing the UK's carbon dioxide emissions."

The full public perceptions survey report is at [www.tyndall.ac.uk/publications/EnergyFuturesSummary.pdf](http://www.tyndall.ac.uk/publications/EnergyFuturesSummary.pdf)

Dr Kevin Anderson's analysis of the Energy Review is in a Tyndall press release for 11 July at [www.tyndall.ac.uk](http://www.tyndall.ac.uk)



# Carbon cost of \$150 should stimulate low-carbon innovation

The first comparison of different economic models that simulate innovation in low-carbon technologies has been coordinated by Jonathan Köhler of Cambridge University and the Tyndall Centre with colleagues Michael Grubb, Ottmar Edenhofer and Carlo Carraro. He has led a consortium of international researchers to improve the analysis and understanding of the economics of climate stabilisation. Climate stabilisation is the phrase for preventing the amount of carbon dioxide in the atmosphere to go above a concentration that will cause dangerous climate change. It is the central concept to mitigating global greenhouse gas emissions.

Scientists think that to prevent a global temperature rise above 2 degrees Celsius, carbon dioxide concentration in the atmosphere has to be stabilised in the range 450 or 550 parts per million. The current CO<sub>2</sub> concentration is 380 parts per million and has risen by around 100 parts per million since the 1800s.

Central to stabilisation is the global cost of achieving it. The rising price of carbon, based on the principle that the polluter

pays, is critical to stimulating innovation in climate change technology. Just as if water had a high cost per litre then Government, industry and perhaps even individuals would do more to save water and design and invest in water-saving technologies. So too a higher cost of carbon would trigger new emissions reducing actions.

Jonathan's comparative study shows that the mean of the different costs of carbon calculated by leading models to stabilise the atmosphere at 450 parts per million by 2030 to be between \$100 and \$150 per tonne. (The current spot price of carbon in the EU is between €10 and €20 per tonne.) At this level, the carbon cost is an economic incentive to stimulate innovation in new low-carbon technologies. One of the models suggests that carbon prices need to peak between \$100 and \$200 per tonne, and then decline as low-carbon technologies dominate the emerging economies of the industrialising world.

In four out of ten models, the cost to Global Domestic Production (GDP) of stabilisation at 450 parts per million is about 1 per cent by 2050. This is less than one year's growth

in economic wealth. On the other hand, one model shows a GDP loss of 10 per cent for achieving such a stabilisation. After 2050, the models are more divergent, with losses to GDP increasing significantly in two models, but GDP actually benefiting from stabilisation in another two models.

"Innovation in technology is something that we economists have long debated as an exceptionally complex area for economic theory. With this study we gathered together a range of leading models and expertise to look for where different economic models agreed and disagreed. The development and diffusion of low carbon technologies will be central to stabilizing the climate over the twenty-first century" says Jonathan.

## **i** Further information

jk235@econ.cam.ac.uk and *The Energy Journal Special Issue, (2006) Endogenous Technological Change and the Economics of Atmospheric Stabilisation, Vol 27.*





## “the concept of shocking the public into action is flawed”

*Hollywood's The Day After Tomorrow had an influence on film goer's risk perception but this was not backed-up by behavioural change*

© 2004 Twentieth Century Fox

# Hollywood film does not influence climate change behaviour

It was mostly pre-release propaganda from campaigning organisations that 2004's eco disaster blockbuster from 20<sup>th</sup> Century Fox was going to improve public understanding of climate change. The Chief Executive of the Government's Energy Savings Trust said of the world's 37<sup>th</sup> top grossing film, “We hope that *The Day After Tomorrow* will help to break consumer apathy towards climate change. Even if we can get a small number of the film's audience to make the link between climate change and what they do in their day to day lives, then this will be a big achievement.”

Tom Lowe, a researcher of public understandings of risk from the University of East Anglia and the Tyndall Centre, is exploring the extent to which film taps into psychological function. “Persuasive risk communication must have a content which triggers attention, is unambiguous, definitive and easily interpretable”. *The Day After*

*Tomorrow* ticked many of these boxes, but also departed the realms of reality and understanding.

Tom and colleagues surveyed over 300 cinema-goers in 2004 while they were queuing to see the film and when they came out. Three months later they convened focus groups to explore longer-term perceptions. A later, controlled experiment compared the perceptions of film viewers to those of individuals reading scientific information. It was found that the film increased short-term anxiety about environmental risks and some viewers experienced difficulty in distinguishing science fact from dramatised fiction. In particular, the dramatic portrayal reduced belief in the likelihood of extreme events as a result of climate change. This effect, combined with the predominantly American iconography, tended to distance the film from reality in the eyes of this British

audience. The focus groups showed that any increase in concern appeared short-lived, with most viewers seeing the film as purely entertainment. In comparative studies of film-goers in Germany, Japan, US and Cambridge UK, a decrease was also detected in viewers' estimations of the likelihood of global climate change. Tom concludes, “The powerful imagery had an influence on risk perceptions, but this was not backed-up by behavioural change. In the case of climate change, immediate responses and behaviour are not entirely related. The concept of shocking the public into action is flawed.” The only significant difference between the film-goers and the readers of scientific literature was that the film distanced its viewers from climate change.

**i Further information**  
thomas.lowe@rmit.edu.au

**Tyndall Technical Report 43**



© Statoil/Kjetil Alsvik

# Next century of power station pollution can be stored underground

Underground storage of carbon dioxide emitted from UK power stations could be sufficient to store a century's worth of carbon dioxide at current emissions levels concludes a major study of the geological, environmental, technical, economic and social implications of technologies for carbon capture and storage. The technique of carbon capture and storage (CCS) scrubs the carbon dioxide from power stations' emissions before they reach the chimney. Once captured, the carbon dioxide is pumped underground for storage.

With the majority of the UK's coal fired power stations due to be retired during the next 15 to 20 years, the UK is at a decision-point for installing clean-coal power stations. China, India and the US all use large quantities of coal and will increase in the future. Carbon capture and storage is a potential bridging-gap while genuinely clean energy technologies are developed, enabling use of the world's vast coal reserves. "There is a need to design

new coal-powered stations so that they are capture-ready for when CCS becomes commonplace" says Clair Gough at Tyndall Centre Manchester.

The UK is well placed to exploit the capture and underground storage of carbon dioxide and has a large offshore storage capacity in disused oil and gas fields and saltwater aquifers. The case studies of power stations in the East Midlands and Yorkshire show the cost to be between £25 and £60 per tonne of carbon dioxide. This is two to four times the current price of a tonne of carbon dioxide in the EU emissions trading scheme.

The assessment also shows that in addition to its technical and economic feasibility, it is also potentially acceptable to the public (against social and environmental criteria), provided it is adopted as a portfolio of measures for mitigating climate change. It is also likely to be a more acceptable option for the public than nuclear fission.

*The cost of capture and underground storage of carbon dioxide is £25 to £60 per ton shows a comprehensive study led by Tyndall Manchester. Statoils Sleipner, pictured, already injects CO<sub>2</sub> beneath the North Sea*

The greatest uncertainty surrounding the technology is whether the stored carbon dioxide will leak from the reservoirs. Assessments will need to be site specific and sites monitored long term, which will likely mean transferring the responsibility to the state once the storage site has closed.

"One of the benefits to our industry stakeholders of carbon capture and storage is that it fits readily into the existing infrastructure of power stations and the electricity grid" says Clair.

**i Further information**  
clair.gough@manchester.ac.uk or  
*Shackley and Gough (Eds) Carbon Capture and its Storage: An Integrated Assessment. Ashgate.*

**“in addition to its technical and economic feasibility, it is also potentially acceptable to the public, provided it is adopted as a portfolio of measures for mitigating climate change”**



# Hurricane Survival Guide for Overseas Territories

© NASA

“June too soon, July stand by, August come it must, September remember, October all over” says a Caribbean rhyme where hurricanes are so common that generations of islanders have passed-along the poem. Drawing upon the practical experience of these islanders and the latest academic thinking, Emma Tompkins and colleagues from the Tyndall Centre at the University of East Anglia have written a guidebook to help the islands of the UK Overseas Territories and other regions prepare for the impacts of hurricanes, storms and sea level rise - predicted to change as global warming further influences the climate.

“While established media networks made Hurricanes Katrina and Rita seem like a new phenomenon for 2005, the small islands of the Caribbean are hit each year and every year. There are many lessons that can be learned from these islands about the importance of anticipatory action. I hope that those countries which have a less well established response will be open and willing to learn from these small islands.” said Emma.

## “by preparing for climate change you make yourself more resilient to other emergency situations”

The in-depth research into understanding disaster risk management for hurricanes and climate change lies behind the guidebook and this was possible through Dr Tompkins’ partnership with the Cayman Islands’ Government and funded through the UK’s DFID. Over the past 15 years the Cayman Islands has developed an exemplary hurricane preparedness strategy. It also recently confirmed its intention to the UK Government to sign the United Nation’s Framework on Climate Change and to join the UK’s commitment to the

Kyoto Protocol. It is the only UK Overseas Territory to do so, in no small measure due to the Tyndall Centre’s collaboration with the Islands’ Government.

The guidebook describes in detail the reasons why climate change is creating risks for small islands, argues why small islands need to address these risks, and proposes methods for managing them. The survival guide provides information, ideas, tools and techniques to help people living on small islands prepare for climate change.

At the centre of the survival guide are eight elements for adaptation to climate change ranging from identifying responsibility for preparedness, through planning and legislation, to the science and the financing. Though primarily aimed at governments and public workers who want to learn more about the impacts of climate change and how to start preparing their island, it is also useful for other organisations and businesses who want to develop plans.

Over two thousand copies have been downloaded from the Tyndall website since the guide was launched on 1 December 2005 at the UN Montreal climate change conference.

“We have had a good idea of what climate change can bring and small islands which are on the frontline of climate change need to start adapting now. Adaptation and preparedness to extreme weather and climate change is a no-regrets policy” said Emma “By preparing a society and infrastructure for future climate change you make yourself resilient not only to extreme weather, but to other emergency situations as well”.

### **i** Further information

The full guidebook is downloadable at [www.tyndall.ac.uk/publications/surviving.pdf](http://www.tyndall.ac.uk/publications/surviving.pdf)

*Emma Tompkins’ Hurricane Survival Guide evaluates lessons from the Cayman Islands hurricane preparedness strategy. In 2004, Hurricane Ivan, pictured, lashed-out at the Cayman Islands with maximum sustained winds of 240 km/hr (150 mph) and a storm surge as high as 25 feet*



# Sea level rise may boost some beaches

Accelerated sea level rise from global warming is certain to increase coastal flooding and erosion in general, but the first integrated analysis of a coastal region under climate change shows that some UK beaches may increase rather than reduce in size. These larger beaches will in some locations provide additional defences against rising sea levels and would reduce the likelihood that big waves overtop and cause coastal land to be flooded.

It is well known that the building of a sea wall for one area, say to protect its eroding cliffs, can weaken the beaches of its neighbouring communities by reducing their supply of beach sediment. Likewise the removal of a sea wall can boost its neighbour's beaches, making them less vulnerable to subsequent sea level rise and storms. It appears that a similar effect would bring benefit to some areas through the large volumes of sediment released as cliff recession increases under climate change.

This study is the first time the flood and erosion risk of a coastal region has been analysed in an integrated way. The long period over which the predictions have been made and inclusion of climate change are also unique features of this work.

By fully understanding one area, the methodology can be rolled-out to other coastlines and communities. Tyndall's integrated coastal models together represent 50 kilometres of the North Norfolk coast and the Norfolk Broads for the next 100 years. The models are driven by simulations of wave conditions, climate change, sea level rise and different strategies for coastal management. The model describes the development of the coastal form to better understand future erosion, beach development and the reliability of sea defences. Overall flood risk is assessed by combining the likelihood of flooding with the economic costs that would ensue.

Tyndall's Coastal Programme of research is better understanding coastal erosion, its impacts and the engineering choices available through the integration of models of climate change, wave conditions, erosion, flooding, ecology, communities and costs. Importantly, the Programme is also exploring how the results of the work can be effectively communicated to decision-makers, and how coastal communities can usefully adapt.

Engineers at Newcastle University are providing the models of erosion and flood risk for the Coastal Programme, which is led by Professor Robert Nicholls at the University of Southampton and Professor Andrew Watkinson at the University of East Anglia.

** Further information**

[mike.walkden@newcastle.ac.uk](mailto:mike.walkden@newcastle.ac.uk)

**“the first time that the flood and erosion risk of a coastal region has been analysed in an integrated way”**





# Exploring adaptation to climate change in southern African communities

Rural communities in southern Africa which depend on natural resources for their everyday livelihoods have had to cope with climate variability and change for millennia. A team led by Tyndall Oxford has looked at how farmers respond and adapt to climate variability, drought and flood. Their aim is to better understand what characteristics drive how people cope and adapt with a changing climate. By understanding the recent past they hope to better understand the future.

Over the next fifty years in Southern Africa, scenarios of climate change show that there will be significant warming of the average air temperature, more seasonal variability, lower yearly rainfall, as well as more extreme weather.

Fieldwork and interviews showed that people living in these areas were clearly recognising changes in rainfall among the many complex factors that disrupt their resource-dependant livelihoods. Three study regions in South Africa have been investigated because of their changing timing of rain onset, frequencies and intensities and different types of regional climate. A fourth region in southern Mozambique has provided a different rural context to investigate how people

are adapting to flood and drought. A forthcoming publication in the scientific literature will highlight how their adaptation is subtly differentiated by climate, capacity of their household and individual perception of risk.

To further understand the adaptation of the households and communities, the research also draws on new insights from the theoretical understanding of the resilience of socio-ecological systems to changes and shocks. It focuses on how markers of success, such as capacity to adapt, stability and self-organisation, are achieved through individual activities as well as through collective actions.

Understanding the types of adaptation at national and local scales and how they interact with each other is important both for successful policy delivery and for equitable development in southern Africa. These are explored in two forthcoming papers focusing on livelihood adaptation to disturbances in rural Mozambique and what makes successful adaptation to climate change in southern Africa. A new project is now considering these and other lessons for effective adaptation and international development across the African continent.



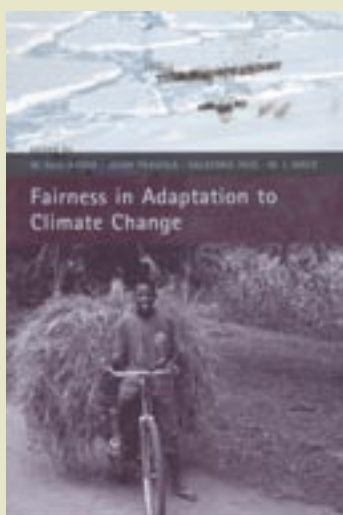
© Henny Osbahr

*Tyndall Oxford's study of what makes successful adaptation in southern African communities focuses on capacity to adapt, stability, and self-organisation through individual and collective actions*

In addition to Tyndall Centre researchers from the UK, the project team included an Oxfam representative, the University of Cape Town and Potchefstroom University in South Africa, Nzuzi Development Association, Save the Children US and National Institute for Disaster Management in Mozambique.

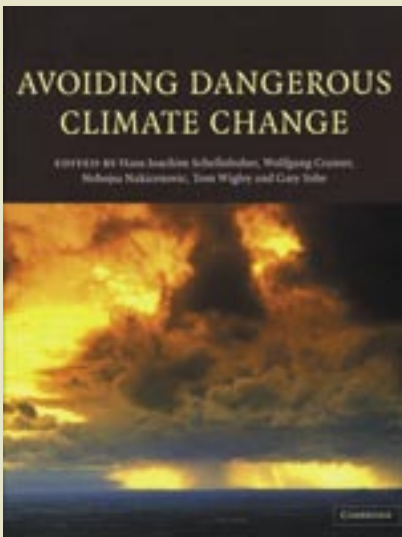
## **i** Further information

dthomas@ouce.ox.ac.uk,  
henny.osbahr@ouce.ox.ac.uk and  
c.twyman@shef.ac.uk



## Fairness in Adaptation to Climate Change published by MIT Press

Edited by Neil Adger and Jouni Paavola of UEA and the Tyndall Centre, Saleemul Huq of the International Institute for Environment and Development and MJ Mace from FIELD, the book brings together scholars from political science, economics, law, human geography, and climate science to offer the first assessment of the social justice issues in adaptation to climate change. The book outlines the philosophical underpinnings of different types of justice in relation to climate change, present inequities, and future burdens, and it applies these to real-world examples of climate change adaptation in Bangladesh, Tanzania, Botswana, Namibia, and Hungary. It argues that the key to adapting to climate change lies in recognizing the equity and justice issues that are inherent both in its causes and in the range of possible human responses.



## Avoiding Dangerous Climate Change

published by Cambridge University Press

Edited by Professor John Schellnhuber, Tyndall's Distinguished Science Advisor and Research Director from 2000 to 2005, this seminal book summarises the UK Government's climate change science conference at Exeter in 2005. Held during the UK's G8 Presidency, the conference was convened ahead of the UK-led G8 Gleneagles Summit. It focuses on three specific questions to gather state-of-the-art science for evidence-based climate change policy. First, for different levels of global warming, what are the key impacts for different regions and sectors and for the world as a whole? Second, what would such levels of global warming imply for stabilising concentrations of greenhouse gases and pathways to achieve the levels? Third, what are the technological options for achieving stabilisation of greenhouse gases in the atmosphere, accounting for economics costs and uncertainties?

## Friends of the Earth urge for Government action based upon Tyndall Centre analysis

The UK Government has only four years to implement a major new programme of action to cut carbon emissions if the nation is to play its part in keeping global temperatures below danger levels, said a report launched in September 2006 by Co-operative Bank and Friends of the Earth, based upon research commissioned from Tyndall Manchester.

Building upon Tyndall's comprehensive report, *Decarbonising the UK*, Friends of the Earth see the research as a roadmap to a low carbon economy that would deliver on the UK Government's commitments to prevent global temperatures from rising by 2°C above pre-industrial levels. It highlights milestones for UK climate change policy for the years 2010, 2030 and 2050.

The report suggests that a cumulative carbon budget of around 4.6 Giga tonnes between 2000 and 2050 would allow the UK to play its part in keeping temperatures



from rising two degree centigrade above pre-industrial levels. If emissions continue at the current rate the UK would emit close to double this amount by 2050.

The study also outlines what the Government could do - and by when - to keep within this carbon budget and maps out how homes, business and transport in the UK could change as a result. The report demonstrates that the UK can achieve the necessary carbon reductions if the Government implements a major programme of action within the next four years. Delaying action will require much more drastic and less manageable cuts later on.

The UK needs to achieve significant emission cuts - of around 70 per cent - within the next 30 years. The UK Government target of a 60 per cent cut in emissions by 2050 is not sufficient if the UK is to play an equitable role in keeping world temperature rise to below 2 degrees. The report also points out that total UK carbon emissions have not fallen since 1990. Government calculations under the terms of the Kyoto Protocol which show a decrease are misleading since they fail to take into account emissions from international shipping and aviation.

The leader of Tyndall's Energy and Climate Change Programme, Dr Kevin Anderson said: "Our research demonstrates that the UK can move to a low carbon economy. However the journey will become much more demanding the longer the Government delays taking concerted action. To make a smooth transition to a low carbon future the Government, business and we as individuals need immediately to begin to implement a major programme of action to significantly reduce our carbon emissions."

**"the journey will become much more demanding the longer the Government delays concerted action"**

*Tyndall Manchester research commissioned by Friends of the Earth highlights milestones for UK climate change policy for the years 2010, 2030 and 2050*



# Communities want a say in Shoreline Management Plans

© Environment Agency

As part of Tyndall's coastal programme of research, Jess Milligan and Professor Tim O'Riordan at the University of East Anglia have conducted a number of rigorous surveys of residents' and businesses' opinions of North Norfolk local Shoreline Management Plans. They have found a deep-seated lack of trust in the Plan process and a serious loss of business confidence. But Jess and Tim also have the ear of the communities affected and so are working alongside local residents and business people to help them address the awkward but necessary transition to a more sustainable coastline economy.

Shoreline Management Plans are mechanisms for managing stretches of coastline along natural processes. The Plans are creations of the Environment Agency, which is responsible for shoreline defence, and of the local maritime authorities, who are charged with reducing erosion of vulnerable cliffs and beaches. Various other bodies are also involved, not least the new Natural England, which brings together English Nature, the Countryside Agency and the Rural Development Service.

"Shoreline Management Plans must also win the hearts and minds of local communities. Notably, these include the parishes and residents' groups who are established to campaign for better coastal protection and adequate protection" says Jess. "It is not possible to protect every area of the coastline against natural

**"people look for assurance of adequate sea defences and compensation for loss of property value"**

processes of erosion, and even less so with the impact of sea level rise".

The Tyndall Centre has a long-standing interest in working with threatened coastal communities to create more sustainable and resilient coastlines and viable local economies and livelihoods. Much of this work has concentrated on the North Norfolk coast, especially the region between Cromer and Winterton. This is the most vulnerable section of the strip of former glacial cliffs and low-lying grazing marsh.

There is already a set of Shoreline Management Plans for the whole of England, and these form the basis of investment in coastal protection for the time being. The new generation of plans were due to begin in 2005 and are much more controversial since they explicitly incorporate new policy in favour of managed realignment. Managed realignment is the process of progressively setting back the current location of coastal protection in favour of more resilient

and natural frontage in the form of tidal marshes, mud flats, dune formations and reed beds, designed by nature to accommodate the changing tidal currents, sediment movement and rising sea levels.

While managed realignment has always been official policy, it is now more explicit in the new breed of Shoreline Management Plans. On the other hand, it is still too early to be sure that more natural defences can effectively be reconstructed in highly variable coastal conditions.

The Tyndall surveys show that local people look for better assurance of adequate sea defences, appropriate compensation for loss of property value and even the prospect of their homes eventually being demolished, and for a much clearer perspective on how their businesses and communities may be enhanced as the new Plans evolve.

"We are working within a complicated and unusual task. There are no ready made solutions for such a transformation to a sustainable coastline community. The Tyndall team is working with a wide range of governmental, NGO and community groups to find the best way forward" says Tim.

## **i Further information**

j.milligan@uea.ac.uk and  
t.oriordan@uea.ac.uk



© Paul Glendon/Still Pictures

ADAM is a Tyndall-led project involving 26 organisations from 15 countries to evaluate and design EU adaptation and mitigation strategies

# Assessing and devising EU adaptation and mitigation policies

ADAM is a new EU-funded research project that will lead to a better understanding of the trade-offs and conflicts that exist between European adaptation and mitigation strategies.

ADAM researchers in 26 organisations from 15 countries are examining the extent to which existing policy trajectories in Europe will deliver Europe's commitments to the UN Framework Convention on Climate Change and to the Kyoto Protocol. They are working with stakeholders to develop portfolios of new strategic options where current policy trajectories are insufficient to reduce greenhouse gas emissions in line with EU and international targets.

Dr Henry Neufeldt manages the project from the Tyndall Centre at the University of East Anglia. The project leader is Professor Mike Hulme, Director of Tyndall. ADAM is also a test-bed for using web and other technologies that enable European-wide scientific project meetings where no-one has to travel and pollute.

The research is structured around four domains that integrate to become an overarching framework for strategic policy appraisal. The first domain is laying out

framing scenarios of future change that guide the ADAM analysis around a 2°C and 5°C warmer world. The second domain of work involves appraising policies and governance for achieving international agreements and is developing a Policy Appraisal Framework, a mechanism which will allow policy-makers to examine the effectiveness of different strategic policy options for climate change mitigation and adaptation.

The third domain is evaluating the cost and effectiveness of mitigation policies and their contribution to global carbon dioxide reduction, while the fourth domain is putting together a knowledge base on Europe's vulnerability and adaptive capacity to climate change for identifying priorities for adaptation.

To apply the learning from these four domains, specific case studies are being analysed where both mitigation and adaptation responses are necessary. The case studies are:

- appraising frameworks, strategies, and governance beyond 2012 when the current Kyoto agreement ends;
- restructuring development aid to incorporate climate change into the

- international development agenda; analyzing both the supply and the demand side of the electricity sector to assess novel policies of climate change mitigation and adaptation;
- place-based studies, focusing on areas with distinct environmental problems related to climate change such as water management, forestry, agriculture, bio-energy and planning. The Tisza Basin in Eastern Europe has conflicts around flooding, water contamination and forestry, the Guadiana Basin in Spain is a drought area, and Inner Mongolia in China has issues of water management, desertification and implementing the Kyoto Protocol's Clean Development Mechanism.

“ADAM completes in spring 2009 and we will then have an overarching framework for devising and analyzing EU policy that integrates mitigation and adaptation policies. It will inform the next round of Kyoto negotiations and make for more joined-up consideration of climate change at a European level” says Henry.

**Further information**  
[h.neufeldt@uea.ac.uk](mailto:h.neufeldt@uea.ac.uk)  
[www.adamproject.eu](http://www.adamproject.eu)



Suraje Dessai now has a Fellowship within the Tyndall Centre to look at decision-making frameworks in climate change uncertainty and adaptation



All pictures © Tyndall Centre/Richard Drury



Neil Jennings' PhD is analysing discourses around rapid climate change



Ruth Wood is assessing integrated strategies for mitigating greenhouse gases and air pollution



Seb Carney produced the GRIP software with significant interest from stakeholders



Ali Colls' PhD was a collaboration with the UK's main nature conservation organisations and led by English Nature

## Training the new generation of interdisciplinary researchers

Seven Tyndall-funded and four affiliated PhD researchers working within Tyndall have successfully completed their doctoral training during Phase 1 of the Tyndall Centre, with the majority continuing to work within the Centre. Tyndall-funded PhD researchers were in addition co-funded by outside organisations to ensure that their research was relevant to designated stakeholders.

To ensure interdisciplinary training in keeping with the Tyndall vision, meetings of the PhD researcher network throughout Tyndall Phase 1 brought together PhD engineers, environmental scientists, social scientists and international development researchers to understand each other's approaches and methodologies. In Tyndall Phase 2, this networking approach has been extended across all contract researchers.

**Alison Colls** (UEA), 2006, The carbon consequences of habitat restoration and creation

**Sebastian Carney** (Manchester), 2006, The Greenhouse Gas Regional Inventory Project (GRIP): focus North West

**David Chow** (Manchester), 2005, The effects of future climate change and near-extreme weather on UK office buildings

**Esteve Corbera** (UEA), 2005, Interrogating development in carbon forestry activities: a case study from Mexico

**Suraje Dessai\*** (UEA), 2006, Robust adaptation decisions amid climate change uncertainties

**John McWilliams** (UEA), 2005, Implications of climate change for biodiversity in the UK Overseas Territories, with emphasis on coral reefs

**Emma Lisa Schipper** (UEA), 2004, Exploring adaptation to climate change: a development perspective

**Dorian Speakman\*** (Manchester), 2005, The impact of severe weather upon the UK Fire Service: a study in four regions

**Sophie Nicholson-Cole\*** (UEA), 2004, Imag(in)ing climate change: exploring people's visual imagery, issue salience and personal efficacy

**Petar Varbanov** (Manchester), 2004, Optimisation and synthesis of process utility systems

**Emily Boyd\***, 2004 (UEA), Forests post Kyoto: global priorities and local realities

\* externally funded research

# Twelve months at the Treasury



Simon Dietz has been seconded from academia to work within the Government Treasury team that is reviewing the economics of climate change

"I'm the man who does the algebra and the graphs" explains Dr Simon Dietz when asked about his role within the Government Treasury team that has been interrogating new and existing knowledge about the economics of climate change – the costs of the impacts of climate change, the costs of reducing greenhouse gas emissions, and the costs of adapting to the changing climate. "By algebra and graphs I mean that I have mainly been providing support on economic theory. My job title is Policy Analyst". Simon has worked across the

Review's wide-ranging remit, spanning the discounting of costs in the future if policies are enacted now, comparing the many different ways of measuring impacts, through to evaluating policies and taxes to stimulate international carbon trading.

An environmental scientist turned environmental economist, Simon is a Tyndall Centre Fellow who did his first degree at the University of East Anglia which he followed with further study and a PhD at the London School of Economics. The Secondment came about through a new scheme funded by the academic funding body, the Economic and Social Research Council. Simon is the first Tyndall person to be embedded in Treasury, following two past Tyndall secondments in DEFRA. At least eight other Tyndall researchers have contributed to the Review, including their expertise being contracted-in.

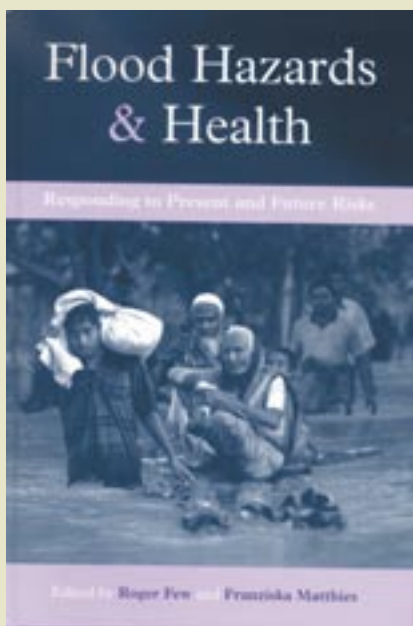
With an ever strengthening consensus that human-induced climate change is a reality, a better understanding within governments, business and academia of the economics of avoiding dangerous climate change is a new constraint to devising policy for society. Named 'The Stern Review' after the man in charge, it is the first such comprehensive report and should be influential over the next few years. The House of Lords

published its own report in 2005 ahead of the G8 Summit in Scotland, but it was not a well-informed report. By focusing on the already much discussed uncertainties around climate change, it took more of a 'wait-and-see what happens' approach.

"Before my secondment I did not really understand how policy works and what policymakers need from academics", says Simon. "Policy people do need to know what the world might be like in 20 years time; but above all they want to know what to do about it now".

He believes that the question of what to do now is where academics can contribute more and formulate rigorous advice. He has found that he has to take academics offline for conversations about what they really think, since this is what policymakers need to know. "In formulating policy advice, civil servants tend to have a broad knowledge and academics a deep knowledge. The weakness of one approach is compensated by the strength of the other. I highly recommend funding for more secondments of academic researchers into policy and business".

**i Further information**  
**Tyndall Working Papers 90 and 91**



## Flood Hazards and Health

published by Earthscan

Earthscan have published the first detailed discussion of the worldwide health implications of flooding and future flood risk, edited by Roger Few and Franziska Matthies of UEA and the Tyndall Centre. With the tragedy of New Orleans still a focus of the world's media, this highly topical book combines rigorous analysis of the human health impacts of flooding with an appraisal of individual and societal response to those risks, and sets these findings in light of potential future increases in flood hazard as a result of climate change. Findings from epidemiological, environmental, social and institutional studies are brought together. The analysis is rooted in an approach that emphasizes the developmental as well as environmental causes of flood risk and the socially differentiated nature of vulnerability and coping capacity. A detailed discussion of the global health impacts of floods and the nature of human response to the health risks posed is reinforced by new research evidence on specific health aspects of floods covering mental health, water and sanitation, local level responses and the responses of health systems.



# Communicating science



Laura Middleton's (UEA) *From Cromer to Kyoto* exhibition is funded by DEFRA's Climate Change Challenge initiative and includes a carbon calculator game, quizzes, information boards and tree-ring analysis



© Laura Middleton

The Tyndall Centre is named after John Tyndall, the Victorian scientist who identified the greenhouse effect, and as Director of the Royal Institution of London a well-known communicator of science. Likewise, the Tyndall Centre strives to communicate its science to wide audiences around the world. Tyndall has policy people, opinion-formers and the media as its key audiences but the Centre looks occasionally to directly engage the general public. Over the past year, researchers have been involved with the British Council's Zero Carbon City campaign and they also played a role at the British Association for the Advancement of Science's annual festival for 2006.

Alex Haxeltine of UEA and Tyndall wrote the original briefing for the British Council's Zero Carbon City campaign, a global initiative to raise awareness and stimulate debate around greenhouse gas emissions. With

much of the world's population now living in cities and responsible for 75 per cent of total energy use, cities are intrinsically linked to any responses to climate change. Not only will this occur through the need for deep cuts in their carbon emissions, but cities also face the challenge of adapting to a changed climate and to sea level rise.

Zero Carbon City is almost certainly the biggest climate change awareness campaign that the world has seen, and separate activities have now taken place in many countries and all continents, from Café Scientifique meetings in city restaurants, through to invitation-only high-level debates with leading opinion-formers, and convening and taking-part in international meetings for young scientists.

The British Association's annual Festival of Science was this year at the University

of East Anglia, the Headquarters and lead institution of the Tyndall Centre. Tyndall Centre researchers ran sessions on sustainable transport and housing for Norfolk as part of a European-wide research project. Discussions were lively as local people decided that cycling, walking and better public transport were what they wanted, with some support for new technologies such as hybrid cars and even personal jet packs. Everyone agreed that they did not want was the same transport as now. Tyndall also chaired a series of public lectures looking at climate and civilization past, the social and scientific history of climate change modelling, and future energy options for UK householders.

In Norwich Cathedral's 900 year old transept was Laura Middleton's DVD-powered 'From Cromer to Kyoto' exhibition, a journey of discovery for cartoon characters Sally and her grandad exploring climate past, climate change future and ways of reducing their energy waste. In addition to talking screens and animations, 'From Cromer to Kyoto' includes a carbon calculator game, display boards and DIY tree-ring analysis. Successfully engaging with the Cathedrals' audiences, the Comments Book shows how interested the public is in engaging more with information around climate change and sustainability.

## **i** Further information

...about Zero Carbon City  
[www.britishcouncil.org/zerocarboncity](http://www.britishcouncil.org/zerocarboncity) and  
 the BA Festival [www.the-ba.net/the-ba/Events/FestivalofScience](http://www.the-ba.net/the-ba/Events/FestivalofScience)





The Archbishop of Canterbury, Dr Rowan Williams, launched the Tyndall Centre's new research strategy in May 2006

© Tyndall Centre

## The Archbishop of Canterbury praises the Tyndall Centre's vision

The Archbishop of Canterbury, Dr Rowan Williams, was guest of honour at the launch of the second phase of the Tyndall Centre in May 2006. He spoke on how the Tyndall Centre project encourages recognising the connections between ecology and economy and that issues about development cannot be counter-poised to issues about environmental justice.

He said, "We're being encouraged quite simply, to be exact and precise about the knowledge we need in order to address the crisis, to think about it in relation to those questions of the unequal balance of power in our world between wealthy and poor." He also spoke of his excitement to see the way in which "... these themes are woven so consistently into the programmes of the years ahead of the Tyndall project."

The topic of justice and equity around climate change was the focus of a new book from the Tyndall Centre that was first published at the launch. *Fairness in Adaptation to Climate Change* by UEA's Neil Adger and Jouni Paavola, IIED's Salameel Huq and MJ Mace from FIELD shows that the concerns of developing countries are marginalised in climate policy decisions and argues that the key to adapting to the impacts of climate change lies in

**"we're being encouraged to be exact and precise about the knowledge we need in order to address the crisis"**

recognizing the justice issues inherent in climate change causes and responses.

A further keynote speaker was Mr John Gummer MP who is the Chair of the Conservative Party's new Quality of Life Policy Group and Former Secretary of State for the Environment. The launch of Tyndall Centre phase 2 celebrated the start of three years further core funding of £5.7m from the UK's Natural Environment Research Council, Engineering and Physical Sciences Research Council and Economic and Social Sciences Research Council. The Centre's phase 1 research strategy spanned 2000-2005.

### **i Further information**

There is a transcript of the Archbishop's full speech that he made on 4 May 2006 at [www.archbishopofcanterbury.org](http://www.archbishopofcanterbury.org)

# Oxford and Newcastle Universities are new Tyndall Centres

Launched in May 2006, the Tyndall Centre's new research strategy for 2006 to 2009 comprises seven programmes with three new research endeavours. A specific new area is asking the question how international development can be sustained in a warming world. It has particular focus on vulnerable communities in Africa and Asia and is designed to help inform last year's G8 outcomes when nations agreed joint actions on both international development and climate change. The new research programme will work closely with development agencies, international donors and vulnerable peoples.

A second new research programme aims to inform international climate policy for beyond the current Kyoto Protocol that expires in 2012. The third new programme is seeking to engineer cities so that they can both grow in size and reduce their climate change vulnerability and greenhouse gas emissions.

The other four of the seven programmes of Tyndall Phase 2 are incremental from the success of the previous research themes focusing on: decarbonising energy; sustainable coastlines; adaptation and resilience; and innovations in integrated climate change modelling and economics.

The Tyndall Centre consortium now includes as new core partners Oxford University, led by Professor Diana Liverman Director of Oxford's Environmental Change Institute, and Newcastle University led by engineer Professor Jim Hall of the Institute for Research on Environment and Sustainability.



## “four of the seven programmes are incremental from the success of the previous research themes”

Oxford and Manchester join the existing core partners of the University of East Anglia, University of Manchester, University of Southampton and the University of Sussex. The distributed design of the Tyndall Centre draws together into a single organisation the UK's wealth of expertise from different academic disciplines to explore what to do about climate change.

High impact policy-relevant outputs from Tyndall phase 1 (2000-2006) were also demonstrated at the launch including: *Decarbonising the UK*, the most comprehensive analysis to date of how the UK can achieve its carbon dioxide emissions reduction targets; *Surviving climate change in small islands*, which is a guide aimed at the British Overseas Territories and other small islands; *Energy Policy* a special issue journal focusing on the economics of innovation for low carbon technologies; *GRIP*, an innovative new

greenhouse gas inventory and scenario software that can be applied to any region or city; and *Avoiding Dangerous Climate Change*, the published proceedings of the Government's 'Exeter Conference' edited by Professor John Schellnhuber, Chair of Tyndall's Science Advisory Board and Distinguished Science Advisor to Tyndall.

### **i Further information**

[a.minns@uea.ac.uk](mailto:a.minns@uea.ac.uk)



Professor Kate Brown is the Tyndall Centre's New Deputy Director for Social Science, based at UEA's School of Development Studies



# Think vegetable Samosa when designing interdisciplinary research



*No vegetable Samosas were cooked, locked in a fridge, dissected or eaten to make possible this light-hearted understanding of interdisciplinary science*

**“in the cooking, some of the ingredients get mashed-together, but many retain their own texture and flavour”**

In May 2006 we published an account that captures our five years of learning about how (and how not) to do interdisciplinary and solutions focused climate change research. Called Truly Useful...doing climate change research that is useful for both theory and practice it is a series of personal reflections about the lessons learned from applying the Tyndall vision to climate change research that is meaningful to stakeholders and informing to policymakers.

Much of the writing is around learning how to set-up and successfully do interdisciplinary research. A focus of our self-understanding is the Tyndall interdisciplinary triangle. Tyndall researchers have each year self-assessed their position within this interdisciplinary triangle to show how they perceive themselves in terms of our three component meta-disciplines of natural science, engineering and physical science, and economic and social science.

So, bear with me while I describe how a well-designed interdisciplinary research organisation or project can be visualised as a well-made vegetable Samosa. It is triangular and has a well-mixed three-dimensional matrix of peas (natural scientists) carrots (engineers) and potatoes (social scientists and economists). In the cooking, some of the ingredients get mashed-together (interdisciplinary experts), but many retain their own texture and flavour (specialist individuality).

This mix of hybridised expertise and specialisation is the critical factor. A traditional environmental research organisation would consist of specialist filling with no mixing and the different flavours clustered at each apex of the Samosa. An entirely interdisciplinary organisation would have all the expertise mashed-up and concentrated in the centre, but would then have no discrete specialists.

Good interdisciplinary research requires the interdisciplinary experts and the discrete specialists researching in unison and only in combination are they a successful recipe beyond the sum of their parts, like a well-made Samosa.

This whole-system (whole-flavour?) approach is key in addressing the problem of climate change and is best exemplified by the four flagship projects of Tyndall Phase 1. A good example is the coastal simulator. It combines coastal engineers and flood modellers (carrots) working together with social scientists (potatoes) analysing community decision-making in the planning process, and ecologists (peas) understanding the impact of sea-level rise on sea-bird breeding grounds. Mixed appropriately and cooked together, it is at the middle of the interdisciplinary Samosa that they work together to give a detailed integrated picture for the future of coastal communities and planning.

#### **Further information**

[a.minns@uea.ac.uk](mailto:a.minns@uea.ac.uk) or

**Tyndall Briefing Note 14**

# Tyndall Technical Reports

This final section summarises the Technical Reports of the Tyndall Centre that are free to download without registering at [www.tyndall.ac.uk](http://www.tyndall.ac.uk). Technical Reports are published at the completion of each Tyndall-funded project.

To date, forty-six research projects have published their final Technical Reports and have produced 255 papers in professional journals. They have also produced 89 Tyndall Working Papers, 106 book chapters and 15 Briefing Notes.

Nicholls R., Hanson S., Balson P., Brown I., French J., Spencer T., (2005) **Capturing Geomorphological Change in the Coastal Simulator**. Tyndall Technical Report 46

Nicholls R., Richards J, Bates P, Dawson R., Hall J, Walkden M, Dickson M, Jordan A, Milligan J, (2005) **Assessing coastal flood risk at specific sites and regional scales: Regional assessment of coastal flood risk**. Theme 4: Tyndall Technical report 45

Weatherhead K, Knox J, Ramsden S, Gibbons J, Arnell N. W., Odoni, N, Hiscock K, Sandhu C, Saich A., Conway D, Warwick C, Bharwani S., (2006) **Sustainable water resources: A framework for assessing adaptation options in the rural sector**: Tyndall Centre Technical Report 44

Lowe T., (2006) **Vicarious experience vs. scientific information in climate change risk perception and behaviour: a case study of undergraduate students in Norwich, UK**: Tyndall Centre Technical Report 43

Atkinson P W., (2006) **Towards an integrated coastal simulator of the impact of sea level rise in East Anglia: Part B3- Coastal simulator and biodiversity - Modelling the change in wintering Twite *Carduelis flavirostris* populations in relation to changing saltmarsh area**: Tyndall Centre Technical Report 42B3

Watkinson A., Gill J., Sutherland W., (2006) **Towards an integrated coastal simulator of the impact of sea level rise in East Anglia: Part B2- Coastal simulator and biodiversity: models of biodiversity responses to environmental change**: Tyndall Centre Technical Report 42B2

Ridley J., Gill J., Watkinson A., Sutherland W., (2006) **Towards an integrated coastal simulator of the impact of sea level rise in East Anglia: Part B1- Coastal simulator and biodiversity - Design and structure of the coastal simulator**: Tyndall Centre Technical Report 42B1

Stansby P, Launder B, Laurence D, Kuang C., (2006) **Towards an integrated coastal simulator of the impact of sea level rise in East Anglia: Part A- Coastal wave climate prediction and sandbanks for coastal protection**: Tyndall Centre Technical Report 42A

Lenton T., Loutre M., Williamson M., Warren R., Goodess C. M., Swann M., Cameron D., Hankin R., Marsh R., Shepherd J., (2006) **Climate Change on the millennial timescale**: Tyndall Centre Technical Report 41

Bows A., Anderson K., Upham P., (2006) **Contraction and Convergence: UK carbon emissions and the implications for UK air traffic**: Tyndall Centre Technical Report 40

Starkey R., Anderson K., (2005) **Domestic Tradeable Quotas: A policy instrument for reducing greenhouse gas emissions from energy use**: Tyndall Centre Technical Report 39

Pearson S, Rees J., Poulton C, Dickson M, Walkden M, Hall J, Nicholls R., Mokrech M, Koukoulas S., Spencer T., (2005) **Towards an integrated coastal sediment dynamics and shoreline response simulator**. Tyndall Centre Technical Report 38

Sorrell S., (2005) **The contribution of energy service contracting to a low carbon economy**: Tyndall Centre Technical Report 37

Tratalos J, Gill J., Jones A, Showler, D, Bateman I, Watkinson A., Sugden R, Sutherland W, (2005) **Interactions between tourism, breeding birds and climate change across a regional scale**: Tyndall Centre Technical Report 36

Thomas C., Osbahr H, Twyman C, Adger W. N., Hewitson B, (2005) **ADAPTIVE: adaptations to climate change amongst natural resource-dependant societies in the developing world: across the Southern African climate gradient**: Tyndall Centre Technical Report 35

Delaney K, Adger W. N., Tompkins E. L, Arnell N. W., (2005) **Vulnerability to abrupt climate change in Europe**: Tyndall Centre Technical Report 34

Anderson K., Shackley S., Mander S, Bows A., (2005) **Decarbonising the UK: Energy for a climate conscious future**: Tyndall Centre Technical Report 33

Halliday J, Peters M., Powell J, Ruddell A, (2005) **Fuel cells: Providing heat and power in the urban environment**: Tyndall Centre Technical Report 32

Haxeltine A., Turpenny J., O'Riordan T., Warren N, (2005) **The creation of a pilot phase Interactive Integrated Assessment Process for managing climate futures**: Tyndall Centre Technical Report 31

Nedic D, Shakoor A, Strbac G, Watson J, Mitchell C, Black M, (2005) **Security assessment of future electricity scenarios**: Tyndall Centre Technical Report 30

Shepherd J., Challenor P, Williamson M., Lenton T., Huntingford C, Ridgwell A, (2005) **Planning and Prototyping a Climate Module for the Tyndall Integrated Assessment Model**: Tyndall Centre Technical Report 29

Lorenzoni I., Pidgeon N., Lowe J., (2005) **A strategic assessment of scientific and behavioural perspectives on 'dangerous' climate change**: Tyndall Centre Technical Report 28

Boardman B, Killip G, Darby S, (2005) **Lower Carbon Futures: the 40% House Project**: Tyndall Centre Technical Report 27

Dearing J., Plater A., Prandle D., Richmond N., Wolf J, (2005) **Towards a high resolution cellular model for coastal simulation (CEMCOS)**: Tyndall Centre Technical Report 26

Timms P., Kelly C., Hodgson F., (2005) **World transport scenarios project**: Tyndall Centre Technical Report 25

Brown K, Tsimplis M, Tompkins E. L, Few R., (2005) **Responding to climate change: inclusive and integrated coastal analysis**: Tyndall Centre Technical Report 24

Anderson D., Kohler J., Barker T., Pan H., Warren R., Winne S., Agnolucci P., Ekins P., Foxon T., Green K, (2005) **Technology policy and technical change a dynamic global and UK approach**: Tyndall Centre Technical Report 23

Abu-Sharkh S., Li B, Markqvart T, Ross N, Wilson A, Steemers K, Kohler J., Arnold R, Yao R, (2005) **Microgrids: distributed on-site generation**: Tyndall Centre Technical Report 22

Shepherd D, Jickells T, Andrews J, Cave R, Ledoux L, Turner K., Watkinson A., Aldridge J, Malcolm S, Parker R, (2005) **Integrated modelling of an estuarine environment: an assessment of managed realignment options**: Tyndall Centre Technical Report 21

Dlugolecki A., Mansley M., (2005) **Asset management and climate change**: Tyndall Centre Technical Report 20

Shackley S., Bray D, Bleda M, (2005) **Developing discourse coalitions to incorporate stakeholder perceptions and responses within the Tyndall Integrated Assessment**: Tyndall Centre Technical Report 19

Dutton A, Bristow A, (2005) **The Hydrogen energy economy: its long term role in greenhouse gas reduction**: Tyndall Centre Technical Report 18

Few R., (2005) **Health and flood risk; A strategic assessment of adaption processes and policies**: Tyndall Centre Technical Report 17

Brown K, Boyd E., Corbera E., Adger W. N., (2004) **How do CDM projects contribute to sustainable development?**: Tyndall Centre Technical Report 16

Bristow A, Tight M, May A, Berkhout F, Harris M, (2004) **How can we reduce carbon emissions from transport?**: Tyndall Centre Technical Report 15

Levermore G, Chow D, Jones P, Lister D, (2004) **Accuracy of modelled extremes of temperature and climate change and its implications for the built environment in the UK**: Tyndall Centre Technical Report 14

Jenkins N, Strbac G, Watson J, (2004) **Connecting new and renewable energy sources to the UK electricity system**: Tyndall Centre Technical Report 13

Hanson C, Holt T, Palutikof J., (2004) **An Integrated Assessment of the Potential for Change in Storm Activity over Europe: Implications for Insurance and Forestry in the UK**: Tyndall Centre Technical Report 12

Berkhout F, Hertin J, Arnell N. W., (2004) **Business and Climate Change: Measuring and Enhancing Adaptive Capacity**: Tyndall Centre Technical Report 11

Tsimplis M, (2004) **Towards a vulnerability assessment for the UK coastline**: Tyndall Centre Technical Report 10

Gill J., Watkinson A., Cote I, (2004) **Linking sea level rise: coastal biodiversity and economic activity in Caribbean island states: towards the development of a coastal island simulator**: Tyndall Centre Technical Report 9

Skinner C, Fergusson, Kroeger K., Kelly C., Bristow A, (2004) **Critical Issues in Decarbonising Transport**: Tyndall Centre Technical Report 8

Adger W. N., Brooks N, Kelly M., Bentham G., Eriksen S., (2004) **New indicators of vulnerability and adaptive capacity**: Tyndall Centre Technical Report 7



