BIODIVERSITY AND ECOLOGY

Only the lonely

NICOLA MITCHELL

Proc. R. Soc. B.
doi:10.1098/rspb.2008.0438 (2008)
A rare 'living fossil' reptile will go the way of the dinosaurs if rising temperatures trigger all of its eggs to hatch into male offspring.

Embryos of the tuatara — an arm-length, spiny-crested creature that closely resembles its Mesozoic ancestors — develop as males in warmer underground nests and females in cooler ones. To forecast this New Zealand native's demographic future, Nicola Mitchell of the University of Western Australia and colleagues modelled nest microclimates for the rarest tuatara species, *Sphenodon guntheri*. Modest seasonal warming of 0.1–0.8 °C by the 2080s would boost the proportion of males slightly, they found. But if air temperatures rise by 4 °C, a possibility under a maximum-warming scenario offered by the New Zealand Climate Office, all hatchlings will be male unless females shift nesting sites or eggs are laid later.

Already wiped out on the main islands of New Zealand by introduced mammals, tuataras survive only on small offshore outposts with little room to move towards the more temperate south. To ensure a supply of females throughout the twenty-first century, the scientists say, conservation workers could artificially shade tuatara nests after the mothers have buried their eggs and left the scene — or relocate the reptiles to cooler areas.

Anna Barnett

ENERGY

Fuelling the future

GGPHOTOWORLD, ISTOCKPHOTO

Env. Sci. Tech. doi:10.1021/es800052w (2008)
Biofuels could be part of a sustainable energy solution if grown on abandoned agricultural lands, suggests a new study. Once hailed as a magic bullet for producing clean energy, biofuels, such as ethanol made from corn, have recently had their green credentials attacked by critics who say the production of plant-based fuels can contribute to world food shortages and to climate change.

Combining historical and satellite data with ecosystem modelling, Elliott Campbell of the Carnegie Institution of Washington and colleagues estimated that over a billion acres of once productive land now lies fallow throughout the world. Their new global inventory of abandoned agricultural lands equates to 66–110 per cent of previous estimates and about one-quarter of the global land area currently in use for growing crops.

Though this land has been discarded by conventional food crop producers, it could still be suitable for low-input crops such as switchgrass. Planting all of the available area with biofuel crops would meet up to eight per cent of current energy needs in countries such as the United States, say the authors, meeting a small but meaningful fraction of the global energy demand.

Olive Heffernan

BIODIVERSITY AND ECOLOGY

Migratory mismatch

ERIC POST

Phil. Trans. R. Soc. B. **363,** 2369–2375 (2008)
The early onset of Arctic springtime threatens to shrink populations of migratory species such as caribou, scientists say. The large herbivores time their arrival to make the most of nutritious plants available in the region, but rapidly rising temperatures mean that they are now out of sync with the plant growing season.

Eric Post of Penn State University and his research partner, who monitor the caribou that come to calve in the Kangerlussuaq region of west Greenland, investigated how rising temperatures are affecting plants that form the staple food supply of these animals. They found that a 4.63 °C rise in spring temperatures between 2002 and 2006 shifted the growing season of plants forward by 14 days. Over the same period, the number of caribou born fell fourfold. The researchers attribute the drop in juvenile caribou to the mismatch in timing between the emergence of new plants and the onset of the calving season.

The results bode ill for the reproductive success of large herbivores that migrate to the Arctic, which is warming at least twice as fast as other areas of the globe.

Anna Armstrong

CRYOSPHERE

To melt Greenland

ROBAS, ISTOCKPHOTO

Geophys. Res. Lett. **35,** L12503 (2008)
The Greenland ice sheet could melt completely and irreversibly if 3,000 gigatonnes of carbon dioxide are released into the atmosphere, according to scientists. Loss of the Greenland ice is of major concern, given that it could cause sea level to rise by as much as seven metres.

Sylvie Charbit at the Laboratoire des Sciences du Climat et de l'Environment, Gif-sur-Yvette, France, and colleagues simulated the long-term stability of the Greenland ice sheet under various carbon dioxide emissions scenarios. Under scenarios where cumulative emissions are less than 2,500 gigatonnes of carbon dioxide (GtC), the ice sheet melts only partially and even begins to recover within

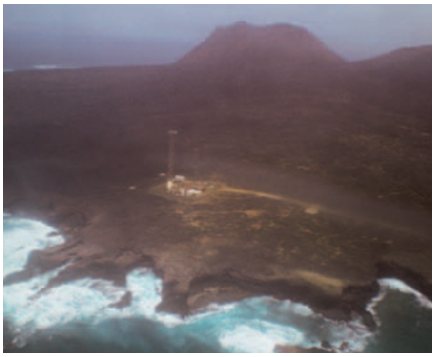
several thousand years. However, above 3,000 GtC, melting is rapid and complete, and persists for tens of thousands of years. The researchers did not include other greenhouse gases such as methane and nitrous oxide in the model, which suggests that their estimates of the carbon threshold are conservative.

Although current cumulative carbon dioxide emissions are on the order of 350 GtC, total emissions may reach 2,480 GtC by AD 2100 under worst-case scenarios — so unless emissions are curbed, runaway melting of Greenland may be triggered in the coming centuries.

Alicia Newton

ATMOSPHERIC SCIENCE

A natural detox



JAMES MCQUAID

Nature **453,** 1232–1235 (2008)

Naturally occurring chemicals are destroying greenhouse gases in the lower atmosphere over the tropical Atlantic much faster than previously thought. The amount of ozone being depleted by halogens is 50 per cent greater than assumed in state-of-the-art chemistry models. The breakdown of ozone, a greenhouse gas, also cleanses the atmosphere of another powerful heat-trapping gas, methane.

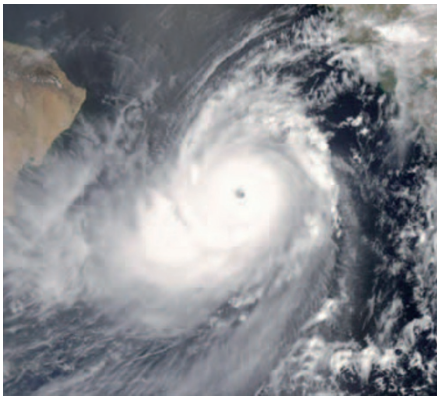
Lucy Carpenter at the University of York and colleagues used records of greenhouse gases from the new Ocean–Atmosphere Observatory in the Cape Verde islands and supplemented these data with airborne measurements to assess ozone trends in the region. They found that ozone was being depleted much more rapidly than expected from chemistry models, even though the models simulated other atmospheric gases accurately. The researchers link depletion of the greenhouse gas to the presence of the halogens bromine and iodine, produced by sea spray and phytoplankton, which destroy ozone and prevent its formation.

Although the study suggests that tropical ocean regions are a larger ozone sink than once thought, whether this applies to the global ocean is yet unknown. The results highlight the need to include halogen chemistry in future climate models.

Alicia Newton

EXTREME EVENTS

Causing a stir



NASA

Glob. Biogeochem. Cycles
doi:10.1029/2007GB003028 (in the press)

Tropical cyclones can increase carbon storage in the Arabian Sea, according to one analysis of the region after a moderate cyclone hit. Usually the surface waters of the Arabian Sea are still and unproductive, but the passing of a cyclone forces nutrient-rich waters up from below, increasing growth of phytoplankton and their export of carbon to deeper waters.

Hema Naik of the National Institute of Oceanography, India, and colleagues used shipboard measurements of ocean chemistry to examine the effect of a 1998 cyclone on the region's nutrient content. During this event, they found, the amount of nitrate drawn up to surface waters was enough to fuel production of approximately 4.2 million tonnes of organic carbon, equivalent to five per cent of the total amount that sinks beneath the surface of the Arabian Sea each year.

The latest scientific evidence suggests cyclones may become more intense with global warming. The authors say that if geographically limited, short-lived cyclones of moderate intensity like the one examined here can affect marine carbon production, then climate-induced changes in cyclone activity could significantly alter carbon cycling in these waters.

Anna Armstrong