EARTH SCIENCE

Marsh attacks

KAREN MCKEE / US GEOLOGICAL SURVEY

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Climatic warming by greenhouse gases is causing sea levels to rise, but two new studies find that elevated CO_2 might also help protect coastal marshes from going under. Sea level rise will destroy a marsh only if it outpaces the build-up of land, and CO_2 can encourage plant growth that swells the soil.

Patrick Megonigal of the Smithsonian Environmental Research Center in Edgewater, Maryland, and colleagues studied how fast soils gained elevation under increased CO_2 by exposing plots in a Chesapeake Bay wetland to concentrations of the greenhouse gas that were raised by 340 parts per million above ambient levels over two years. Whereas control plots lost 0.9 millimetres per year on average, the high-CO_2 plots gained 3 millimetres per year, driven by the amplified growth of plant roots, which added volume and mass to the soil. The boost was diminished, however, if nitrogen was added to the plots, a likely effect of pollution from expanding cities and fertilizer use.

In a companion study, Julia Cherry of the University of Alabama and co-workers transferred plots of marsh to the lab, where they mimicked the effect of an encroaching ocean. They found that high CO_2 stimulated plant growth and land build-up even when marshes were flooded with saltwater.

Anna Barnett

CLIMATE PREDICTION

Top models

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Geophys. Res. Lett. **36,** L06710 (2009)

When it comes to simulating temperatures in specific regions, some global climate models are more skilful than others. For Australia, new research finds, those that reproduce past regional temperatures best also consistently project smaller increases in extreme temperatures in the future, relative to other models.

Sarah Perkins and colleagues at the University of New South Wales in Sydney tested nine global climate models for their skill in replicating past climate, by comparing their simulations of temperature extremes in Australia from 1981 to 2000 with observations. For each region of the continent, they picked the three models that performed best. This select group of models shows that if greenhouse gas emissions continue to grow, the very hottest days of 2081–2100 — the kind of scorchers that occur once every 20 years on average — will be 2 °C hotter than a century beforehand almost everywhere, and 5–7 °C hotter in the hardest-hit places. But if all models are included, peak temperature over most of the continent shoots up to 3–5 °C higher than a century ago.

The authors conclude that focusing on the best-performing models for a given region significantly changes climate projections. Since Australia includes both temperate and tropical climates, this effect could be widespread around the globe.

Anna Barnett

EARTH SCIENCE

Clear-cut carbon

Glob. Biogeochem. Cycles
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While re-growing, razed forests may sequester enough CO_2 to offset a substantial amount of the carbon lost to logging and other land-use change, a new model shows. Through practices such as clearing forests and cultivating cropland, humans have altered 42–68 per cent of the Earth's surface and added over a hundred billion tonnes of carbon dioxide to the atmosphere.

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Now Elena Shevliakova of Princeton University, New Jersey, and colleagues provide the first global estimate of how much of the CO_2 emitted from land has been offset by re-growth, using a model of CO_2 sources and sinks in terrestrial ecosystems. To cover a range of possible land-use changes that may have taken place, they used four different scenarios. They found that even extensive human interference caused the net loss of only 1.1–1.3 billion tonnes of carbon per year in the 1990s — about half of previous estimates. One factor that may explain this, they say, is the 0.35–0.6 billion tonnes of carbon absorbed annually by plants growing back after disturbance, mostly in tropical forests.

The researchers suggest that replenishing of forests could be one of the 'missing' sinks that scientists have been seeking to help them balance the global carbon budget.

Anna Armstrong

BIODIVERSITY AND ECOLOGY

Sustaining sanctuary

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Ecology Lett. **12,** 420–431 (2009)

As the climate changes, conservation areas will probably lose some species they were originally designed to protect, but overall they could still provide an important buffer against biodiversity loss. A new study finds that a network of important bird sites across sub-Saharan Africa should continue to afford protection to more than 88 per cent of the region's endangered inhabitants, despite anticipated changes in climate.

David Hole, of Durham University, UK, and colleagues examined the resilience of the sub-Saharan network, which holds 1,608 bird species, to a moderate emissions scenario over three time periods.

Community turnover — a measure of the change in species composition — increased throughout the twenty-first century, and reached an average of 26 per cent by 2085. But biodiversity fared well across the network, with, on average, 74–80 per cent of current bird species persisting in protected areas through to 2100. Of 815 species of conservation concern, 714–746 retained suitable habitat as the climate changed. Only seven or eight of the priority species lost climatically suitable habitat within the network by the end of the century.

Certain areas, such as the tropical highlands and the Namib-Karoo deserts, were particularly susceptible to species loss, however, and could lose up to 63 per cent of their priority bird species by 2100.

Anna Armstrong

CLIMATE IMPACTS

High and dry

US BUREAU OF RECLAMATION

Proc. Natl Acad. Sci. USA
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Millions of residents in Mexico and the southwestern United States who rely on the Colorado River for their water supplies may be left high and dry by the middle of the century. If temperatures continue to rise in the region, as anticipated, less runoff will mean that by 2050 the river will be unable to deliver the required water almost 60 to 90 per cent of the time.

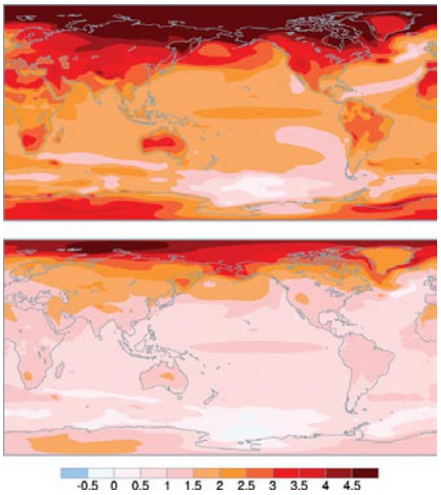
Tim Barnett and David Pierce of the Scripps Institution of Oceanography in San Diego, California, assessed the ability of the Colorado River to meet the demand from scheduled future water deliveries under different climate change scenarios. The authors found that under a conservative scenario of 10 per cent less runoff, expected water deliveries will fall short by 2040, and that with 20 per cent less runoff, water supplies will be inadequate to meet demand by 2025.

By mid-century, shortfalls are anticipated to exceed 1 billion cubic metres of water each year, equivalent to the water usage of 1.6 million households. Given the expected influx of 20–30 million people to the region by 2050, the authors conclude that drastic changes in water use will be necessary to prevent regular shortages.

Alicia Newton

MITIGATION

Cuts curb impacts



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Geophys. Res. Lett. **36,** L08703 (2009)

Some of the worst potential impacts of climate change — such as loss of Arctic sea ice and permafrost — could be minimized if greenhouse gas emissions were cut 70 per cent this century. Those are the reductions required to stabilize atmospheric concentrations of the gases at 450 parts per million (p.p.m.), above which there is a greater than 30-per-cent risk of dangerous climate change.

Warren Washington of the US National Center for Atmospheric Research in Boulder, Colorado, and colleagues used a suite of models to assess how the climate would respond to a business-as-usual emissions scenario, in which atmospheric concentrations reach 800 p.p.m. this century, and a mitigation scenario, in which greenhouse gases are stabilized at 450 p.p.m. Under the mitigation scenario, average surface temperatures would rise by only 0.6 °C — a quarter of that expected under business as usual. Moreover, Arctic warming would drop by 3 °C, potentially deadly heat waves would be 55 per cent less intense and at least eight centimetres of sea level rise could be averted.

The investigators note that such dramatic emissions cuts may not be politically or economically feasible but nevertheless urge policymakers to adopt targets and embrace green technology, conservation practices and carbon-sequestration programmes to avoid the most severe consequences of climate change.

Alicia Newton