CARBON DIOXIDE FERTILIZATION

Hot, dry and greening

Geophys. Res. Lett. http://doi.org/mqx (2013)

Increased atmospheric CO_2 concentrations can have a direct effect on plant growth in addition to indirect effects through changes in climate. Carbon dioxide is required for photosynthesis and the potential for a 'CO_2 fertilization' effect has long been recognized and studied in laboratory and field experiments. Satellite observations reveal a greening of the globe over recent decades — a pattern that would be expected if CO_2 is enhancing vegetation growth. However, disentangling the drivers of the greening trend is complicated, as there are many potential influences.

Randall Donohue from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, and co-workers reduced the complexity of the attribution task by focusing on warm, dry environments where the CO_2 fertilization effect on plants should be most pronounced.

They predict — based on gas exchange theory — that recent increases in atmospheric CO_2 should have led to a 5–10% increase in green foliage. Satellite observations, with the effects of rainfall variations removed, indicate that vegetation cover has increased by 11%. These results confirm the anticipated CO_2 fertilization effect and show that it is a significant land surface process. *AB*

SPECIES REDISTRIBUTION

The devil's in the detail

Ecol. Lett. http://doi.org/msf (2013)

Ecological responses to climate change are a function of the local patterns of variability in weather and microclimate superimposed on global and regional changes in mean conditions. Modelling the combined effects of fine-scale climate variations on populations in a fragmented landscape may be important for the accurate prediction and conservation management of shifts in species range.

To investigate the importance of such high-resolution analysis, Jonathan Bennie from the University of Exeter, UK, and co-workers modelled the relationship between microclimate and population dynamics for a butterfly (*Hesperia comma*) and its northern range margin in the UK.

They find that the inclusion of dynamic microclimate information improved model accuracy in simulating observed changes in population density and patch occupancy. This study shows how fine-scale, short-term environmental variability can drive rates and patterns of range expansion through localised, intermittent episodes of expansion and contraction. *AB*

METEOROLOGY

Weather and climate

Clim. Dynam. http://dx.doi.org/msg (2013)

Climate change should be considered not only on timescales of years to decades, but also in terms of daily weather. Short timescales are particularly important for understanding the risk of extreme weather events. At present, climate models are tested on their performance in simulating long-term climate variability and change, with less consideration for shorter periods.

Ok-Yeon Kim of the APEC Climate Center, Republic of Korea, and co-workers investigate mean interdiurnal (day-to-day) variability (MIDV) using fifteen CMIP5 climate models. They assess the model representations of surface maximum and minimum temperature, surface wind speed and precipitation for the present climate and use the three best-performing models for projections for 2030–2056 and 2073–2099.

Forecasts of MIDV showed reduction in land surface maximum and minimum temperature over high latitudes in the winter, with a stronger reduction in minimum temperature. The Northern Hemisphere was found to have reduced wind speed over large land areas in the spring, and increased precipitation in the mid-latitudes in spring and winter. Weather conditions influence us in our daily lives, and this study shows that climate models can provide insight into the future of our weather. *BW*

CLIMATE IMPACTS

Thirsty biofuels

Environ. Sci. Technol. **47,** 6030–6037 (2013)

In 2012, the US experienced the most severe drought for 50 years, resulting in a 12% decrease in corn production. This revealed that policy targets on feedstock-specific fuels — such as corn ethanol — are vulnerable to extreme weather conditions under climate change.

Rosa Dominguez-Faus of the University of California, and colleagues estimated the impact of climate change on water requirements for irrigated corn ethanol production in key regions of the US over a 40 year period. They used a GIS-integrated biophysical model, coupled with temperature and precipitation predictions from five general circulation models and atmospheric CO_2 concentrations from IPCC scenarios. Simulations showed that climate change would increase the evaporative water consumption of the corn ethanol production needed each year to comply with the Energy Independency and Security Act by 10%, and the irrigation water consumption by 19%. Corn yields would decrease, on average, even if the projected increase in irrigation demand is met. These results highlight the need to re-evaluate the sustainability of the US biofuel policy that requires feedstock-specific levels. *MC*

ADAPTATION

Relocation hurdles

Proc. Natl Acad. Sci. USA **110,** 9320–9325 (2013)

Populations living in coastal areas are threatened by frequent extreme weather events that accelerate climate-induced biophysical change. In extreme cases, the only viable adaptation strategy is the relocation of entire communities.

Robin Bronen of the Alaska Institute for Justice, and F. Stuart Chapin III of the University of Alaska, examined the case of three Alaska Native communities — Kivalina, Shishmaref and Newtok — in need of relocation. They found that the lack of clear relocation guidelines that outline the steps a community must take to relocate, including criteria for site selection, has been the main barrier to relocation in Kivalina and Shishmaref. In the case of Newtok, the absence of a designated agency with statutory mandates and funding to supervise the relocation effort has delayed the process significantly. This underlines the need for an institutional framework that, by removing federal and state statutory barriers, allows government agencies to technically and financially assist the relocation of communities and describes the necessary steps for relocation planning. Local leadership and integration of social and ecological well-being into adaptation planning are also critical. *MC*

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