OCEAN ACIDIFICATION

Flourishing seaweed

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Macroalgae (seaweed) form an important component of rocky shore ecosystems, so an understanding of their sensitivity to ocean acidification is important for understanding the wider ocean acidification impacts on coastal ecosystems.

To investigate the long-term impact of acidification on macroalgae and their sea-urchin grazers, Vivienne Johnson, from the Marine Biology and Ecology Research Centre, University of Plymouth, UK, and co-workers compared ecological assemblages in subtidal rocky shore systems along carbon dioxide gradients created by volcanic seeps in the Mediterranean and off the coast of Papua New Guinea.

Results were consistent across the temperate and tropical systems with species of the calcifying macroalgal genus *Padina* showing reductions in calcium carbonate content with carbon dioxide enrichment. Nevertheless, an increase in the abundance of *Padina* spp. in acidified conditions was observed. Reduced sea-urchin grazing pressure and significant increases in photosynthetic rates are thought to explain the unexpected success of decalcified *Padina* spp. at increased levels of carbon dioxide. Similarities in the responses of *Padina* spp. and sea-urchin abundance across carbon dioxide vent systems increases confidence in the generality of these observations for large geographical areas. *AB*

ECOLOGY

Interaction benefits

Science **336,** 1028–1030 (2012)

A key challenge in understanding and predicting ecological response to climate change relates to the way that different species interact. Changes in the nature of current interactions have the potential to strongly amplify or attenuate direct climate effects on individual species.

Rachel Pateman, from the Department of Biology, University of York, UK, and co-workers documented changes in the range of the butterfly *Aricia agestisover* in the United Kingdom over the past ~30 years, and found that the species has expanded northwards by 79 kilometres.

The rapid rate of range expansion was explained by the ability of the butterflies to use different plants as hosts for their caterpillars. Historically, the butterfly was largely restricted to a single plant species, but recent warmer conditions have enabled the butterfly to increasingly use a more widespread plant species, substantially increasing available habitat. This is a particularly interesting case, because interactions among species are often seen as constraints on species' responses to climate change, but these data show that temperature-dependent changes in species interactions can also help to facilitate change. *AB*

HYDROLOGY

Catchment interactions

Wat. Resour. Res. http://doi.org/hx2 (2012)

The effects of climate change, atmospheric carbon dioxide and atmospheric deposition on the hydrology and water quality of watersheds are potentially important for the continued provision of many ecosystem services, from biodiversity and amenity value to freshwater resources. Investigating these interacting effects is, however, a difficult task.

Afshin Pourmokhtarian, from the Department of Civil and Environmental Engineering, Syracuse University, USA, and co-workers used a hydrochemical model to evaluate the effects of potential future changes in temperature, precipitation, solar radiation and atmospheric carbon dioxide on major chemical elements at the Hubbard Brook Experimental Forest in New Hampshire, USA over the twenty-first century.

Model simulations under climate change displayed a shift in hydrology characterized by later snowpack development, earlier spring snowmelt, greater evapotranspiration and a slight increase in annual water yield. Under elevated temperature, net soil nitrogen mineralization and nitrification was simulated to increase markedly, resulting in acidification of soil and stream water and altering the quality of water draining from forested watersheds. However, the authors note that invoking a carbon dioxide fertilization effect on vegetation can substantially mitigate watershed nitrogen loss, highlighting the need for a more thorough understanding of carbon dioxide effects on forest vegetation. *AB*

ECONOMICS

Australia's carbon farming

Land Use Policy **30,** 496–506 (2012)

Predictions of the economic viability of new forestry plantings for climate change mitigation in Australia's cleared agricultural lands are highly uncertain. Regional differences in site quality and management and planting practices are the main sources of uncertainty.

Keryn Paul, of the Commonwealth Scientific and Industrial Research Organisation, Australia, and colleagues examined three case studies in Australia (two of farm forestry and one of biodiverse environmental plantings) and found on average 39 per cent variation in their

POLICY

Adding value with biofuels

Food Policy **37,** 439–451 (2012)

Biofuel production has increased remarkably over the past decade, with ethanol reaching 66.6 million tons and biodiesel 13.5 million tons in 2009. Given the rise in agricultural commodity prices since 2006, the food versus fuel debate continues to swirl.

Jikun Huang, of the Center for Chinese Agricultural Policy, Beijin, and colleagues assessed the impacts of ethanol and biodiesel production in the United States, European Union and Brazil on local agriculture, and related sectors, over the period 2006–2020. By using a model linking agriculture and energy markets, they found that low energy prices reduce the demand for biofuels, whereas high energy prices can lead to production levels exceeding policy mandates. They also analysed the global impacts of biofuel production on food markets and found that increasing biofuel production is likely to push up prices of feedstock and non-feedstock commodities in developing countries.

The researchers emphasize how the emergence of biofuels can add value to the agricultural sector, with benefits, at the global level, to landowners and workers. *MC*