AGRICULTURE

Crop losses in Taiwan

Agr. Econ. **43,** 205–214 (2012)

Taiwan is extremely vulnerable to sea-level rise owing to its geophysical conditions — the land rises from the sea to a mountain chain within 50–60 km. At least 60% of the total cultivated land is low lying and therefore exposed to the risk of inundation.

Ching-Cheng Chang, of the National Taiwan University, and colleagues estimated the costs of sea-level rise and climate variability on agriculture in Taiwan. In particular, they considered the effects of sea-level rise on cropland and the effects of increases in temperature and precipitation on crop production under different climate change and crop-yield scenarios. To evaluate the economic impacts, the researchers incorporated the climate change effects into a model of the Taiwanese agricultural sector representing the production of 75 commodities — 85% of Taiwan's total agricultural product value.

They found that, for sea-level rise of up to 5 m, 4.9% of total acreage and 16% of rice acreage would be lost. The economic damage due to sea-level rise ranges from NT$0.84 billion to NT$4.10 billion and crop yield losses range from NT$1.79 billion to NT$2.55 billion. *MC*

ECOLOGY

Plants lose genetic diversity

Proc. R. Soc. B. http://dx.doi.org/10.1098/rspb.2011.2363 (2012)

Loss of genetic diversity associated with reductions in species' ranges under climate warming is likely to reduce the potential for local adaptation, thereby increasing extinction risk.

To assess the genetic consequences of range reduction of cold-adapted species, Inger Alsos, of Tromsø University Museum, and colleagues analysed the genetic diversity of 9,581 samples from 1,200 populations of 27 northern plant species differing in adaptive traits. They found that genetic diversity varied considerably between species, which was largely explained by genetic differentiation between populations together with dispersal adaptation.

Based on computer simulations, the researchers expect the range reductions for the northern plant species studied to be more severe than previously reported for temperate plants, and that all are likely to lose genetic diversity by 2080. The simulations also highlight the importance of plant traits in determining potential vulnerability to climate change, predicting, for example, that herbs lacking adaptations for long-distance dispersal will lose genetic diversity more quickly than dwarf shrubs adapted to long-distance dispersal. *RH*

CARBON FERTILIZATION

Underground competition

Glob. Change Biol. http://dx.doi.org/10.1111/j.1365-2486.2011.02596.x (2011)

Increased atmospheric carbon dioxide (CO_2) and ozone (O_3) are known to influence photosynthesis and plant growth. What is less clear is how small-scale experiments translate to complex communities such as forests, where competition within and between species, especially for growth-limiting soil nitrogen, can influence plant growth responses.

Donald Zak, from the University of Michigan in the United States, and co-workers used a nitrogen isotope tracer in a 12-year free-air carbon enrichment experiment to assess soil resource acquisition by contrasting genetic variants (genotypes) of aspen, and in mixed aspen–birch and aspen–maple communities. This allowed them to determine whether increased CO_2 and O_3 had interactive effects on soil nitrogen acquisition and whether belowground competition for resources changed over time.

They found that the effect of increased CO_2 and O_3 on the uptake of soil nitrogen differed between aspen genotypes as well as between species, and that responses changed as young trees developed. Moreover, compensatory growth by CO_2-responsive individuals sustained higher rates of forest productivity under increased CO_2, whereas compensatory growth by O_3-tolerant individuals was not observed in response to increased O_3. These findings

OCEANOGRAPHY

Canada Basin freshening

Nature **481,** 66–70 (2012)

Between the early 1990s and the late 2000s, the surface waters of the Arctic Ocean's Canada Basin became far less salty, raising fears that ocean circulation could be altered and the Earth's climate system perturbed.

Much of the fresh water came not from melting sea ice, but from runoff from land masses. Using observations taken between 2005 and 2008, when sea ice was at a record low, James Morison, of the University of Washington, and colleagues cast doubt on the theory that fresh surface water converged in the Canada Basin because of clockwise winds driven by strengthening of the Beaufort High — a characteristic peak in sea-level atmospheric pressure.

They found that the Canada Basin received extra fresh water from the Eurasian Basin owing to an anticlockwise shift in the ocean pathway of Eurasian runoff. This shift was caused by a strengthened west-to-east Northern Hemisphere atmospheric circulation associated with changes in atmospheric pressure gradients related to the Arctic Oscillation.

The findings highlight the importance of the Arctic Oscillation in modulating runoff pathways and their effects on the Arctic Ocean, and suggest that the Beaufort High has a less dominant influence on Canada Basin freshening than previously supposed. *RH*