El Niño and Infectious Disease

The idea that climatic cycles such as the El Niño/Southern Oscillation significantly affect infectious disease, raised by Rita R. Colwell (Association Affairs, 20 Dec., p. 2025) in the context of cholera outbreaks, is supported by recent findings from veterinary, entomological, and botanical epidemiology (*1*, *2*).

Botanical epidemiologists have found that plant systems have unique advantages for macro-scale, long-term epidemiological studies. Weather and climate are important driving forces affecting plant disease development. For example, the U.S. Department of Agriculture's annual cereal rust survey, a program started in 1917 to monitor rust outbreaks over North America, accumulates time series of disease intensity, yield loss, and races of rust fungi in cereal crops (*3*). With these data, consistent and significant coherence patterns between El Niño and wheat rust intensity have been found in both the Eastern and Western hemispheres (*2*).

Studies of El Niño–disease associations and their underlying mechanisms could lead to the development of early warning systems. Colwell advocates the use of satellite surveillance for predicting cholera outbreaks, while others propose using El Niño forecasts for malaria alerts (*4*). Outbreaks of wheat scab in eastern China can be predicted successfully 4 months in advance by measuring sea surface temperatures in the central Pacific ($R^2 = 0.86$; $P < 0.001$) (*5*); the mechanism for this association is thought to be the El Niño–dependent advance of the summer monsoon through East Asia, whereby increased precipitation causes increased infection by the scab pathogen. El Niño–disease studies are important also in the context of climate change research: infectious diseases driven by multiyear climatic cycles are likely to respond to slow, decadal changes in climate as well.

X. B. Yang
Department of Plant Pathology,
Iowa State University,
Ames, IA 50011, USA
E-mail: xbyang@iastate.edu
Harald Scherm
Department of Plant Pathology,
University of Georgia,
Athens, GA 30602, USA
E-mail: scherm@uga.cc.uga.edu

References

1. M. P. Ward and S. J. Johnson, *Prev. Vet. Med.* **28**, 57 (1996); J. Adis and M. Latif, *Biotropica* **28**, 403 (1996).
2. H. Scherm and X. B. Yang, *Phytopathology* **85**, 970 (1995).
3. J. V. Groth and A. P. Roelfs, *ibid.* **77**, 1395 (1987); D. L. Long *et al.*, *ibid.* **85**, 1168 (1995).
4. M. J. Bourma and H. J. van der Kamp, *Trop. Med. Int. Health* **1**, 86 (1996).
5. S. Zhao and C. Yao, *Acta Phytopathol. Sin.* **19**, 229 (1989).

■

Atmospheric Nitrogen Deposition

David A. Wedin and David Tilman (Reports, 6 Dec., p. 1720) show that increased nitrogen inputs to terrestrial ecosystems might cause smaller increases in the capacity of those ecosystems to store carbon than expected. Their findings are important because nitrogen inputs have increased dramatically over the past decades through fertilizer production, cultivation of nitrogen-fixing legumes, and production of oxides of nitrogen associated with fossil-fuel burning (*1*). However, the simultaneous increase in atmospheric carbon dioxide (CO_2) concentrations caused by burning fossil fuels is likely to at least partially counteract the processes that limited carbon storage in Wedin and Tilman's experiment. CO_2 enrichment generally increases the amount of carbon fixed by plants per unit of nitrogen taken