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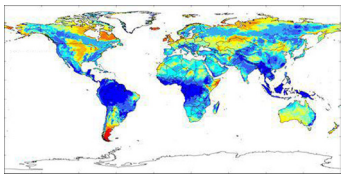
In This Issue

ENVIRONMENTAL SCIENCES, SUSTAINABILITY SCIENCE

Potential of wind power

Despite the contributions of wind power to the total amount of electricity produced in the United States, wind-based energy makes up only a small percentage of this total. Using data from an array of global meteorological sources and a simulation of global wind fields, Xi Lu et al. found that a network of wind turbines could produce up to 40 times the current global consumption of electricity. In their analysis, the authors excluded forested, urban, and ice-covered landscapes, as well as ocean areas >92 km from shore. By estimating the potential electricity produced by a wind turbine based on wind speed, air density, the spacing of the turbines, and the size of their blades, the authors calculated that land-based wind power in the contiguous United States could provide 16 times more electricity than the amount currently used. Potential barriers to wind farms include identifying suitable locations and environmental and aesthetic objections to offshore turbines. Based on the turbines operating at >20% of their capacity, wind power has the potential to meet current and future global electricity demands, according to the authors. — C.A.



Distribution of global wind power capacity (blue, low; red, high).

"Global potential for wind-generated electricity" by Xi Lu, Michael B. McElroy, and Juha Kiviluoma (see pages 10933–10938)

ANTHROPOLOGY

Identification of an ancient Middle Eastern granary

The start of the Neolithic period marked the transition from hunter-gatherer bands to the formation of large, stable settlements. Crucial to this transition was the development of long-term storage for food, although the archaeological record is unclear as to the exact timing of this development. Using evidence gathered from an excavation in Dhra', near the Dead Sea in Jordan, Ian Kuijt and Bill Finlayson identified 3 distinct types of structures, 2 of which were likely used for housing and for plant processing, and 1 likely used as a simple granary. Designed with suspended floors, likely for air circulation and protection from rodents, the granary had a circular base with a diameter of ≈3 meters, and had walls of mud and stone with light upper walls of wattle. The authors identified phytoliths in the granary that closely matched wild barley (*Hordeum spontaneum*). Radiocarbon dating of burnt wood beam associated with the granary structure dated construction to ≈11,200–11,300 years before present. Although the granary predates plant domestication, it provides some of the earliest evidence of significant human involvement in the plant life cycle, the authors conclude. — C.A.

Neolithic storage granary from Dhra', Jordan.

"Evidence for food storage and predomestication granaries 11,000 years ago in the Jordan Valley" by Ian Kuijt and Bill Finlayson (see pages 10966–10970)

SOCIAL SCIENCES

NIH funding and health dynamics

Funding the National Institutes of Health (NIH) is a potent form of economic stimulus. Kenneth G. Manton et al. analyzed the trends in total human mortality, and mortality from 4 chronic diseases—cardiovascular disease, stroke, cancer, and diabetes—from 1938 to 2004, and compared these to the level of funding for the institutes responsible for studying those diseases. The authors identified 4 major shifts in national health that correlated with funding changes since the formation of the NIH in 1948. The authors report a decline in cancer deaths after a nearly 20-year rise in the NIH budget, largely fueled by the "war on cancer." The authors also found a slowing of health improvements after a decline in funding from 1990–1997, and a slight up-tick after the 1998–2003 doubling of the NIH budget. Manton et al. analyzed the

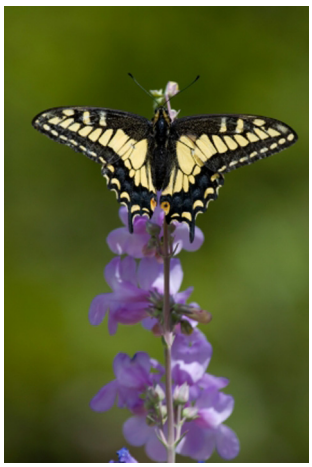
economic benefits of improvements in healthcare and showed that biomedical research and new health policies delayed the onset of chronic disease and disability, keeping the US workforce healthier longer. The authors argue that the economic gains scored from an older, healthier workforce exceed the increases in the NIH budget. Given current economic and demographic estimates that the US labor force is expected to grow more slowly in the next decade—from 1.2% per annum from 1996 to 2006 to 0.3% after 2017—the authors recommend that the NIH budget be further expanded to increase healthcare gains. — B.P.T.

"NIH funding trajectories and their correlations with US health dynamics from 1950 to 2004" by Kenneth G. Manton, Xi-Liang Gu, Gene Lowrimore, Arthur Ullian, and H. Dennis Tolley (see pages 10981–10986)

ECOLOGY

Butterfly adaptations to global warming

For species fully occupying their thermal niche, global climate change may expand their territories for peripheral populations. However, barriers such as limited tolerance for altered climates and limited availability of food can block this expansion. Shannon Pelini et al. exchanged specimens of 2 species of butterfly (*Erynnis propertius* and *Papilio zelicaon*) that live along the Pacific Coast from the latitudinal center of their range (southwestern Oregon) to their northern limits (Vancouver Island, BC), and performed experiments in growth chambers to study the effects of temperature change and host plant suitability on butterfly growth and survival. Both populations of *E. propertius* showed increased growth and survival in warmer temperatures during the summer months, and northern populations showed local adaptations to northern winters. This local adaptation to winter conditions could counteract the benefits of warming during the summer. Both populations of *P. zelicaon* showed the opposite effects: decreased growth and survival in warmer temperatures. The authors conclude that peripheral enhancement is unlikely, thereby reducing the potential for poleward movement in butterflies, likely due to their complex life histories and the importance of interactions with host plants. — C.A.



Papilio zelicaon. ©iStockphoto.com/milehightraveler.

"Translocation experiments with butterflies reveal limits to enhancement of poleward populations under climate change" by Shannon L. Pelini, Jason D. K. Dzurisin, Kirsten M. Prior, Caroline M. Williams, Travis D. Marsico, Brent J. Sinclair, and Jessica J. Hellmann (see pages 11160–11165)

GENETICS

Genomic rearrangements in sea lampreys

Certain metazoan species, such as copepods and ciliates, undergo extensive genomic rearrangements during development, including the deletion of repetitive sequences and entire chromosomes. However, only one chordate group, the jawless hagfish, is thought to undergo such extensive rearrangements. Jeramiah Smith et al. found that the sea lamprey (*Petromyzon marinus*) eliminates several hundred million base pairs and at least 1 transcribed locus during its development. Flow cytometry revealed that the postmeiotic testes of *P. marinus* contained ≈20% more nuclear DNA than its somatic cells. Germline *P. marinus* cells contain a high copy number of a specific DNA sequence known as *Germ1*, which is present on several chromosomes in the meiotic germline. Southern blots and FISH of the lamprey's somatic cells show a substantial reduction in *Germ1* copy number. Real-time PCR assays revealed that the majority of *Germ1* loss takes place during a brief window at approximately the transition from blastula to gastrula. The genetic rearrangements of the hagfish and sea lamprey may share a common evolutionary origin, which may be traced to a point near the ancestor of all extant vertebrates, the authors say. — C.A.

Sagittal section of a sea lamprey embryo.

"Programmed loss of millions of base pairs from a vertebrate genome" by Jeramiah J. Smith, Francesca Antonacci, Evan E. Eichler, and Chris T. Amemiya (see pages 11212–11217)