MITIGATION

Gas or coal?

Climatic Change **108,** 601–608 (2011)

Coal, as every environmentalist knows, is the filthy fuel. However, a new study by Tom Wigley of the US National Center for Atmospheric Research in Boulder, Colorado, USA, finds that even though natural gas produces only half of the carbon dioxide of coal per unit of energy, a world where gas replaced coal would actually be warmer for many decades.

Some of the aerosols produced from coal combustion have a cooling effect and this, combined with the tendency of natural gas to leak out into the atmosphere — methane is a potent greenhouse gas — overrides the gains from smaller carbon dioxide emissions.

Wigley reports that unless methane leakage rates can be kept below 2%, completely substituting natural-gas power generators for coal ones will not reduce global warming. With no leakage at all, this change would still cause additional warming until 2050; with 10% methane leakage, Earth will get hotter than it otherwise would until 2140. *AP*

TROPICAL FORESTS

Hot and thirsty

Geophys. Res. Lett. **38,** L19704 (2011)

The two recent major droughts in the Amazon Basin, in 2005 and 2010, provided an opportunity to study the effects of drought on tropical forests and improve predictive impact models for the region.

Michael Toomey from the Department of Geography at the University of California, Santa Barbara, USA, and his co-workers analysed remote-sensing data of land-surface temperatures in the Amazon to investigate the contribution of heat stress to the observed changes in aboveground living biomass during the droughts, such as increased tree death.

They found that heat stress was a better indicator of biomass variability during the droughts than water stress — models that only incorporated precipitation patterns were 17% less accurate in predicting the biomass changes than those that only used heat stress. Models that incorporated both heat and moisture stress were the best, able to account for around 65% of biomass variability. Heat stress played an important role in both droughts, the authors conclude, adding that models to predict drought impacts in tropical forests should take account of this. *AB*

SOCIOLOGY

Jobs versus environment

Glob. Environ. Change **21,** 1215–1223 (2011)

Climate change will have a significant impact on economic production in various ways, including through changes to consumption patterns. This will affect workers, and is leading to a 'jobs versus environment' dilemma, which is already an issue for workers and their unions worldwide. For example, when a trades union is confronted with the option of either supporting construction of a new coal-fired power station with guaranteed jobs (and greenhouse-gas emissions) or fighting against construction in the hope of future green jobs (and greenhouse-gas mitigation), it faces a considerable dilemma.

Nora Räthzel from the Department of Sociology at Umeå University, Sweden, and David Uzzell from the Department of Psychology at Surrey University, UK, undertook extensive interviews with senior policymakers in trades unions to investigate the ways in which international trades unions are conceptualizing the relationship between jobs and the environment. They argue that such interpretations could provide an important basis for climate change policies.

Based on these surveys the authors identified four separate ways in which trades unions discuss and engage with the environment. All of these were found to imply a reinvention of trades unions as a social movement, representing more than just their members interests, but only one went so far as to see nature as a partner in human development. The authors argue that incorporating the idea of nature as a partner would enable a decisive shift from existing policy where nature is seen as subordinate to the economy. *AB*

STATISTICS

Blame it on the weather

Proc. Natl Acad. Sci. USA http://dx.doi.org/10.1073/pnas.1104268108 (2011)

Climatic shifts were the ultimate cause of humanitarian crises in pre-industrial Europe, according to a team of investigators based in China. The researchers analysed how 14 variables — describing agricultural production, demography and the economy — varied in relation to one another in early modern Europe, between 1500 and 1800. That period encompasses the region's 'golden' and 'dark' ages, as well as mild and cold phases of the Little Ice Age.

David Zhang of the University of Hong Kong, and his colleagues, used five criteria to assess the causal relationships between their many data sets. Variables such as agricultural production and per-capita food supply showed an immediate response to temperature changes, whereas social disturbances, such as war, migration and famine, tracked the per-capita food availability trend, but with a response lag of several years.

Some details of their project are startling. For example, the average height of Europeans closely followed the temperature, and the number of wars increased 41% in the cold phase of the Little Ice Age. The authors argue that many historical changes typically attributed to social factors actually have their roots in climate changes. *AP*

INORGANIC CHEMISTRY

Approaching photosynthesis

Science http://dx.doi.org/10.1126/science.1209786 and http://dx.doi.org/10.1126/science.1209816 (2011)

Researchers have long struggled to recreate photosynthesis in an industrial setting. Now, one group has found a method of reducing carbon dioxide (CO_2) to carbon monoxide (CO) using an electrical potential difference of less than 1.5 V, and another has managed to generate hydrogen gas by using light to split water molecules.

The first, led by Richard Masel, of Dioxide Materials in Champaign, Illinois, USA, employs a silver cathode to catalyse the formation of CO from an intermediate, $(CO_2)^-$, which reacts with H^+ ions in water. A number of improvements are required before this process can be copied on a large scale, however, including speeding up the reaction rate.

The second group has made cells containing a silicon-based photovoltaic and

an alloy made of abundantly available metals, with cobalt borate catalysts. Steven Reece of Sun Catalytix, a firm in Cambridge, Massachusetts, USA, and his co-workers report that this system could be developed into a means of generating cheap fuel from sunlight, because, unlike similar devices that have been created in the past, this one operates in benign conditions, without wires and expensive noble metal catalysts. *AP*

MITIGATION

Car pool

Proc. Natl Acad. Sci. USA **108,** 16554–16558 (2011)

What type of vehicles most benefit society over their lifetime per dollar spent on building, maintaining and fuelling them? Perhaps surprisingly, it turns out to be hybrid and plug-in hybrid electric vehicles, according to group of researchers led by Jeremy Michalek of Carnegie Mellon University in Pittsburgh, Pennsylvania, USA.

These vehicle classes outdid conventional cars and battery-powered electric vehicles in their analysis. The work takes into account, for example, the power plant emissions associated with charging a plug-in car, the direct costs of oil as well as the military expense associated with defending against disruption in its supply, the impact of greenhouse-gas emissions from exhaust pipes, and vehicle recycling and land filling. The results are subject to certain variables, such as oil price and battery life.

The authors argue that some of the US subsidies for encouraging emission reductions in transportation should be targeted at potential buyers of hybrids, which offer the most social benefit per dollar despite their small battery packs. *AP*

MICROBIOLOGY

Fungi for fuel

Nature Biotechnol. **29,** 922–927 (2011)

Industrial biofuel production using fungal agents is limited by the rate at which the fungi's enzymes break down plant cellulose and other polysaccharides into fermentable sugars. This reaction would occur more rapidly at higher temperatures, but that requires temperature-tolerant — thermophilic — fungi, so that the agent isn't killed in the process.

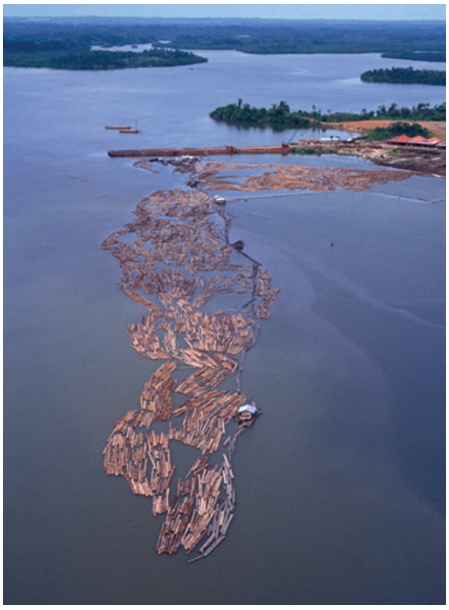
A team led by Adrian Tsang from Concordia University in Montreal, Canada, and Randy Berka of Novozymes in Davis, California, USA, have now sequenced the genomes of two thermophilic species of fungi, *Myceliophthora thermophila* and *Thielavia terrestris*. Both fungi have relatively small genomes and large amounts of heat-stable cytosine and guanine base pairs in the protein-coding regions of their DNA. Both fungi could be enhanced through breeding, as they reproduce sexually.

The authors measured the fungi's responses to a feedstock of barley (mainly cellulose) and alfalfa (which contains more pectin). Both species increased their production of metabolic enzymes, although they responded less strongly to the alfalfa. They would both make excellent industrial decomposers, the researchers say. *AP*

ECONOMICS

Cost of deforestation

Ecol. Econ. **70,** 2503–2510 (2011)



Ghana lost 1.9 million hectares of forest between 1990 and 2005, placing it among the most rapidly deforesting regions in West Africa. Recognizing the economic value of forests could help motivate conservation efforts by local communities and agencies.

Lawrence Damnyag, of the University of Eastern Finland, and his colleagues estimated the monetary value of four ecosystem services — timber, edible fruits, soil nutrients and carbon storage — in both natural and degraded forests located in the Dormaa and Begoro districts in Ghana, during 2008.

They found that the annual timber revenues per hectare in degraded forests were around US$160 lower than in natural forests. The loss of edible fruits in Ghana's degraded forests was estimated to be worth US$777 per hectare per year. Although the researchers didn't find significant differences in the value of soil nutrients between degraded and natural forests, they estimated that in the case of carbon storage, the gross revenue loss per hectare from degraded forests was on average US$492. Added together these estimates equate to a loss of about 2.6% of the 2008 agricultural gross domestic product in Ghana. *MC*

DEFORESTATION

Deforestation changes rainfall

Geophys. Res. Lett. **38,** L19802 (2011)

Replacing forest with pasture or cropland often produces sharp gradients in the landscape, which tend to generate local temperature-induced circulation patterns called 'vegetation breezes' — analogous to sea breezes. These breezes enhance rainfall-generating convection currents.

Luis Garcia-Carreras and Douglas Parker from the Institute for Climate and Atmospheric Science at the University of Leeds, UK, used an ensemble of atmospheric cloud-resolving model simulations to investigate the potential impact of deforestation-generated vegetation breezes on local rainfall.

The results indicate that variation in vegetation cover increases the total locally generated rainfall on average by 13% and produces a particularly pronounced four- to sixfold increase in rainfall over cropland boundaries compared with uniform land cover. However, rainfall was not enhanced everywhere, and was actually reduced by 50% or more over the forest. The authors note that these local- to medium-scale processes can interact with large-scale atmospheric circulation in complex ways, so predicting the change in total precipitation due to deforestation is an ongoing research aim. *AB*

Written by Alastair Brown, Monica Contestabile and Anna Petherick.