PERMAFROST

Accounting for snow types

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Vast accumulations of carbon are stored in Arctic and boreal soils, and understanding of the stability of these stocks to climate warming is a key research question being investigated by scientists from many different disciplines. Soil-carbon stability is related to decomposition processes, which are in turn largely determined by soil thermal regime and cannot be simply related to air temperature.

Field measurements report different thermal properties for the snowpack in Arctic tundra (low shrubs, sedge and moss dominated) and taiga (coniferous and mixed forest dominated) regions. Isabelle Gouttevin, from AgroParisTech/LGGE, France, and co-authors used a modelling approach to quantify the potential influence of these different snow thermal properties on soil thermal regime and terrestrial soil-carbon distribution across the pan-Arctic continental area.

They found that higher insulation by snow in taiga areas induces warmer soil temperatures by up to 12 °C, and up to 4 °C in the summer (at 50 cm depth). These soil temperature changes have implications for soil-carbon stock estimates, which are found to be reduced by 8% across the Arctic continental area when vegetation-induced variations of snow thermal properties are accounted for. Soil-carbon differences are accounted for by complex ecosystem interactions that reduce productivity overall and enhance soil microbial decomposition. *AB*

TECHNOLOGY

Mitigation costs

Sustain. Sci. http://doi.org/hv5 (2012)

Long-term climate targets are being discussed at the international level. At the 2009 G8 summit, the participating nations agreed to strive for a 50% reduction of 1990 levels of global greenhouse-gas emissions by 2050. However, the costs associated with achieving such a cut could be a limiting factor in reaching that goal.

Osamu Akashi, of Musashino University and the National Institute for Environmental Studies, Japan, and colleague Tatsuya Hanaoka investigated the technological feasibility of a 50% reduction by 2050.

The 50% target is technically achievable, but will require great mitigation efforts. The cost to achieve this goal reaches US$600 per tonne of carbon dioxide equivalent and requires a reduction in energy consumption per unit of gross domestic product of 55%. Major changes to energy systems will be required, as carbon dioxide emissions per unit of energy consumption need to be reduced by 75% — meaning switches to renewable energy. The additional investment required for greenhouse-gas abatement technologies would be in the region of US$73 trillion, with the largest investment required in the power generation sector. *BW*

SCENARIO ANALYSIS

Urbanization emissions

Energ. Econ. http://doi.org/hv6 (2012)

Urbanization is a significant demographic and economic trend in developing countries, and has important consequences for development, energy use and human well-being. However, urbanization is rarely directly incorporated into long-term energy and emissions scenario analyses.

Brian O'Neill, from the National Centre for Atmospheric Research, USA, and co-workers investigated the implications of a range of plausible urbanization pathways for energy use and carbon emissions in India and China. They used a model of the global economy that integrates aspects of population, consumption preferences, technology and science, and captures variability in household types within world regions.

The results indicate that changes in urbanization are at present having a slightly less than proportional effect on aggregate emissions and energy use in India and China. The authors find that the influence of urbanization was primarily through enhanced economic growth driven by an increased supply of labour and a rapid transition to modern fuels such as electricity and natural gas. *AB*

ENERGY ECONOMICS

Biofuel economic potential

Ecol. Econ. http://doi.org/hvz (2012)

Biofuels are of increasing interest as we try to decrease our carbon footprint. Carbon neutral (or positive) biofuels can replace traditional fossil fuels, but at what hidden cost? Land clearing is unacceptable, and land-use change will result in less farmland.

Marcello Basili, of the University of Siena, Italy, and Fulvio Fontini, of University of Padua, Italy, report on the (sub)tropical plant *Jatropha curcas* — a non-edible bush suitable for cultivation in marginal and idle land. They investigate the environmental and economic prospects of *J. curcas* as a biodiesel source, and value the investment for Kenya for different levels of interest rate and investment cost.

Their research shows that *J. curcas* yields a positive carbon balance and high-quantity and -quality biodiesel from its seeds. Its cultivation is compatible with maintaining farmlands and conservation areas. The value of the investment is positive and can

MODELLING

Climate and Baltic Sea nutrients *Clim. Dynam.* http://doi.org/hv4 (2012)

The Baltic Sea is expected to experience increased temperature, decreased sea-ice cover and reduced salinity over the coming decades as a result of global warming. These effects, in conjunction with industrial and agricultural practices, could have a significant impact on the marine ecosystem.

Markus Meier, of the Swedish Meteorological and Hydrological Institute, Norrköping, Sweden, and collaborators modelled climate changes and nutrient loads in the Baltic Sea. They used a coupled physical–biogeochemical model with a total of 16 scenario simulations, from 1961 to 2099.

Their results show that, for all scenarios, water temperature increased with increased air temperature, and salinity decreased in response to increased land runoff. Nutrient loads increased for all scenarios. Increased precipitation, which caused greater runoff, combined with increased water temperature to accelerate sedimentary organic material decomposition, leading to increased eutrophication. The authors also predict that bottom oxygen concentrations will decrease as a result of the increased organic matter and nutrient load. Current legislation to reduce nutrient load will not be sufficient, according to this study, to improve water quality at the end of the century. *BW*

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