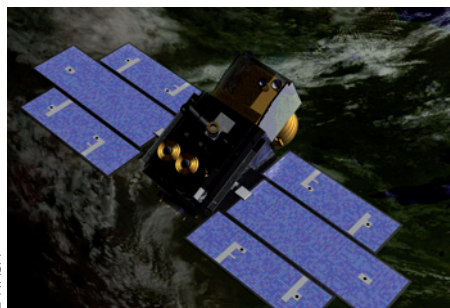# research highlights

MITIGATION
REDDy data
Proc. Natl Acad. Sci. USA
doi:10.1073/pnas.1019576108 (2011)

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To measure the progress of policies such as Reducing Emissions from Deforestation and Forest Degradation (REDD), baseline figures that describe how much standing carbon biomass previously existed in forests all over the world are needed. These are not easy to put together.

A team led by Sassan Saatchi of Caltech's Jet Propulsion Laboratory in Pasadena, California, has combined data from ground measurements, the Geoscience Laser Altimeter System onboard the Ice, Cloud, and land Elevation Satellite (ICESat) and various remote-sensing databases. With this data they generated a map of the carbon locked up in living trees in the early 2000s, for 75 developing countries that until now lacked proper assessments.

The map will provide a benchmark against which future measurements of standing carbon biomass can be assessed, and is intended primarily for analyses at the regional or national scale. These could then be used to inform policymakers across Latin America, sub-Saharan Africa and Southeast Asia — and should prove to be a big improvement over the incomplete forest inventories that have so far been relied on.

AGRICULTURE
On good farming
Glob. Biogeochem. Cycles
doi:10.1029/2009GB003765 (2011)

Climate change could significantly trim crop yields in coming decades, but farmers might avoid some of these losses by altering how they manage their crops. The question is: what should they do?

Delphine Deryng, from the University of East Anglia in Norwich, UK, and colleagues have developed a new global crop model that includes various features of agricultural management, such as irrigation and fertilizer application. They then used their model to estimate worldwide yields for spring wheat, soybeans and maize in 2050 under varying farming practices.

From the model results, they produced a long list of farming tips. For example, to cope with warmer temperatures farmers should pay close attention to new cultivars: sticking with late-twentieth-century varieties of maize and seasonal practices in 2050 will lead to 19–34% smaller maize harvests, whereas sowing new cultivars at the right time would narrow the loss to 6–18%.

Overall, the researchers contend, by selecting appropriate crop varieties and adjusting planting dates, farmers could trim global yield declines by 18% for maize, 12% for spring wheat and 7% for soybeans.

ECOLOGY
Early snowmelt
Geophys. Res. Lett. **38,** L09703 (2011)

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Does an earlier springtime snowmelt cause Arctic tundra to sequester more carbon and thus moderate atmospheric carbon dioxide growth?

Evidence for this idea comes primarily from research that has identified a relationship between interannual variability in Arctic snowmelt and net ecosystem production. However, because few studies have investigated this link at the ecosystem level, it is unclear whether all tundra types respond in the same manner.

Now a study led by Elyn Humphreys of Carleton University in Ontario, Canada, has compared tundra–atmosphere carbon dioxide exchange between 2004 and 2010 at two sites: a mixed upland tundra site and a wet sedge meadow. The researchers report that the relationship between melt date and photosynthetic output differed between the sites, and that variations in the intrinsic photosynthetic capacity of the plants, probably related to leaf area, were the main reason why.

They conclude that snowmelt alone may not be a reliable predictor of net ecosystem productivity — and, therefore, of the resultant balance of carbon dioxide exchange in Arctic tundra.

IMPACTS
Venetian futures
Climatic Change
doi:10.1007/s10584-011-0093-x (2011)

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Venice and its lagoon are potentially very vulnerable to twenty-first-century sea-level rise. However, tidal flooding events are complicated to predict because they result from the interplay of astronomical tide height, global sea level and weather-related bulges in sea level known as storm surges.

To investigate the risk of inundation, Alberto Troccoli from the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Canberra, Australia, and his co-workers studied atmospheric circulation patterns in the northern Adriatic that have, in the past, been conducive to extreme sea-surface height around Venice. They put this data into a model, along with a record of extreme tides, and projected changes in global sea level.

Their results indicate that the type of storm events that help to flood Venice could fall by about 30% this century — meanwhile the relative sea level may rise by around 17 cm (extrapolating current sea-level trends). If correct, these opposite trends would play off against each other such that the frequency of extreme tides in Venice will remain largely unchanged for the next 90+ years. The finding demonstrates that the impacts of climate change must be considered on a location-by-location basis.

MITIGATION
Emissions made in China
Energ. Policy
doi:10.1016/j.enpol.2011.04.027 (2010)

Over the past 30 years, electric commercial equipment and household appliances have become more common in China, which today consumes as well as produces more gadgets than any other nation. When the Chinese government reinforced standards and

labelling programmes to promote efficiency in 2009, it did so without calculating the impact they would have.

However, Nan Zhou, from the Lawrence Berkeley National Laboratory in California, and her colleagues have now calculated the energy savings and carbon dioxide emission reductions of two policy scenarios. Under the first, the Chinese government tightens its energy-efficiency laws in one sharp improvement in 2014. This results in a nationwide drop in electricity consumption of 9,503 TWh and 35% less carbon dioxide emissions between 2009 and 2030 than had no laws been introduced.

Under the second scenario, efficiency standards in China are improved slightly every four to five years. By the same comparison, this would cut electricity use by 5,450 TWh and carbon dioxide emissions by 16%. The authors add that although China's current approach to efficiency appears to be effective at cutting emissions, achieving the predicted savings will require constant enforcement efforts.

IMPACTS
Paradise lost
Climatic Change
doi:10.1007/s10584-011-0080-2 (2011)

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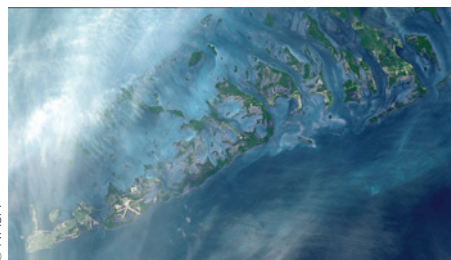
Sea-level rise could flood more than half of the Florida Keys by the end of the century, displacing thousands of residents and causing billions of dollars in damage, a study using particularly high-quality elevation data suggests.

The Florida Keys form an arcuate chain of about 1,700 islands off the southern tip of the Florida peninsula, and stand at less than 2 m above current sea level. John Dittmar, an environmental scientist at Florida International University in Miami, and his colleagues have combined census information, property records and data from an airborne laser altimeter to estimate the damage that would occur on the islands owing to different amounts of sea-level rise.

Should the sea's surface lap just 18 cm higher in 2100 — at the lower end of the Intergovernmental Panel on Climate Change's (IPCC) predicted range — the authors believe that a modified development policy could

keep up with the rate of change. However, if sea levels rose to the higher end of the IPCC's projections in that time, about 70% of the islands' land area would be flooded, impacting more than 11,300 residents and causing property damage in excess of $4.6 billion.

BOTANY
Beijing blossoms
Adv. Atmos. Sci. **28,** 564–572 (2011)

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Woody plants in Beijing, China, are flowering earlier than they did a few decades ago — in line with changes in mean monthly temperatures.

Beijing has a temperate monsoon climate. At present the average daily maximum in July is 26.3 °C, the average minimum in January reaches −3.7 °C and the annual mean is 12.2 °C. However, the city has been getting warmer — by 0.47 °C per decade since 1960.

Junhu Dai, Quansheng Ge and colleagues from the Chinese Academy of Sciences in Beijing have compared the temperature records of the Beijing meteorological station with records of the first flowering date of woody plants in the city, as collected by China's Phenological Observation

Network. On average, the 48 species analysed flowered 5.4 days earlier in 2007 than they did when the observation network began work in 1963.

The authors also note that many species brought forward their first flowering date more for a given rise in mean monthly temperature between 1990 and 2007, when the global warming signal was stronger, than they did between 1963 and 1989.

ATMOSPHERIC SCIENCES
Windswept seas
Geophys. Res. Lett. **38,** L09706 (2011)

Satellite observations as well as climate models suggest that harsh winds will weaken as the Earth's atmosphere gets warmer, according to work by atmospheric scientists at the University of Miami in Florida.

Brian Soden and Guillaume Gastineau analysed twice-daily surface wind-speed measurements between 1987 and 2008, taken by the Special Sensor Microwave Imager. They also used more than two-dozen climate models to examine the affect of sea surface temperature on wind speed during the same period. Both methods indicated that really strong winds become less frequent as tropical oceans warm.

Specifically, the satellite data show that the fastest winds — those in the 99th percentile — occur 30% less often for every 1 °C rise in sea surface temperature. But the drop-off wasn't strongly replicated by the climate models. The researchers suggest that this disparity may be linked to the resolution of the models, which typically have a grid-point spacing of roughly 200 km. That also renders them unable to explicitly resolve the extreme winds associated with tropical cyclones or severe thunderstorms.

AGRICULTURE
Limited options
Atmos. Environ. **45,** 2569-2576 (2011)

Ozone can reduce plant growth when it resides in the troposphere (between Earth's surface and a few kilometres up) instead of contributing to the high-atmosphere ozone layer. How much this lowers the yields of four major global food crops has now been calculated.

Unlike carbon dioxide, ozone in the lower atmosphere varies in concentration over time and space. The coincidence of vigorous crop growth and high ozone levels can significantly cut yields. To quantify the impact — and to investigate how effective agricultural adaptation could be — Edmar Teixeira from the International Institute for Applied Systems Analysis in Laxenburg, Austria, and his colleagues modelled various biophysical and crop-management factors for wheat, soybean, maize and rice grown at different concentrations of atmospheric ozone.

They predict that China, India and the United States will be the three hardest-hit countries, between them shouldering half of all global agricultural losses from ozone. Shifting crop-planting and harvesting schedules in an attempt to avoid ozone peaks is unlikely to decrease damage except in a few cases, such as for rain-fed soybean in India. Irrigated crops suffered the largest losses overall.