CLIMATE CHANGE

Record U.S. Warmth of 2006 Was Part Natural, Part Greenhouse

Climate scientists usually hesitate to point to a single climate extreme and say, "That's the greenhouse at work." Climate naturally swings to and fro so much that it can be tough to pick out the influence of the strengthening greenhouse on a hurricane season, say, or on one country's climate over the course of a year.

But four National Oceanic and Atmospheric Administration (NOAA) climate scientists report in a paper in press at *Geophysical Research Letters* that the greenhouse was behind more than half of last year's record-breaking warmth across the contiguous United States. By their reckoning, global warming in 2006 was aggravating all manner of U.S. extremes: severe droughts, the rising cost of air conditioning, the cold-sensitive pine bark beetle ravaging once-cool western forests, and maybe even some midwinter daffodils.

Last January, NOAA announced that 2006 was the warmest year for the lower 48 states since record-keeping began in 1895; temperatures even eclipsed the El Niño–fueled record of 1998. According to a NOAA press release, El Niño was contributing to 2006's unusual warmth, and the strengthening greenhouse was probably involved too. But NOAA couldn't say which climate phenomenon was more important in setting the new record.

So climate dynamicists Martin Hoerling, Jon Eischeid, Xiao-Wei Quan, and TaiYi Xu of NOAA's Earth System Research Laboratory in Boulder, Colorado, decided to find out what was behind the record. First, to gauge the influence of last year's El Niño, they checked on what 10 actual El Niño warmings of the tropical Pacific had done to U.S. temperatures. They found a slight overall cooling, not a warming, concentrated in the northern states. Then, in two climate models, they simulated the effect of a warmer tropical Pacific on U.S. temperatures. Again, they found a slight cooling. That "leads us to conclude that it was very unlikely that El Niño either caused or materially contributed to the record 2006 warmth," they write.

Next, the NOAA group checked on what greenhouse gases might have con- ▶

Overheated. Too many voracious pine bark beetles are surviving milder western winters.

ECOTOXICOLOGY

Canadian Study Reveals New Class of Potential POPs

Dioxin, PCBs, the pesticide DDT—these pollutants are considered among the most dangerous on the planet because they don't break down easily, are highly toxic, and build up in the food chain. Because these chemicals stay put in our body fat, even tiny amounts in food can add up over time and contribute to health problems such as cancer. So worrisome are the risks that more than 140 countries have endorsed a 2001 international treaty that aims to banish a dozen of these substances from the environment.

Now on p. 236, a Canadian team reports that efforts to crack down on persistent organic pollutants, or POPs, may have missed an entire set of them. The problem is that risk assessment experts now finger potential POPs based on whether they build up in fish food webs. That assumption, the authors argue, based on modeling and field data, could be missing chemicals that fish remove from their bodies but that become concentrated in the tissues of mammals and birds, which have a different respiratory physiology.

One-third of the 12,000 or so organic chemicals on the market in Canada fit this new category, say the study's authors at Simon Fraser University in Burnaby, British Columbia. This study did not examine whether these chemicals are actually harming wildlife and people, they and others are quick to point out. Still, the work "is really raising a red flag and saying we've got to pay attention to this," says ecotoxicologist Lawrence Burkhard of the U.S. Environmental Protection Agency in Duluth, Minnesota.

Biomagnification means that the level of a toxin in animals' tissues rises as one moves up the food chain. For instance, as larvae eat algae, fish eat the larvae, and bigger fish eat smaller fish, the toxin present in the algae becomes increasingly concentrated; top predators like swordfish and polar bears end up with the highest doses in their tissues. This can happen with stable, fatsoluble chemicals that aren't easily excreted in urine or feces. Biomagnification was first studied in the late 1960s in aquatic food webs, explains Frank Gobas, professor at Simon Fraser University and leader of the study. To screen chemicals, scientists began

Toxic web. This wolf devouring a caribou carcass may be ingesting toxic organic chemicals that the caribou picked up from eating lichen.

CREDITS (TOP TO BOTTOM): DAVID MCNEW/GETTY IMAGES; RON NIEBRUGGE/WILDNATUREIMAGES.COM

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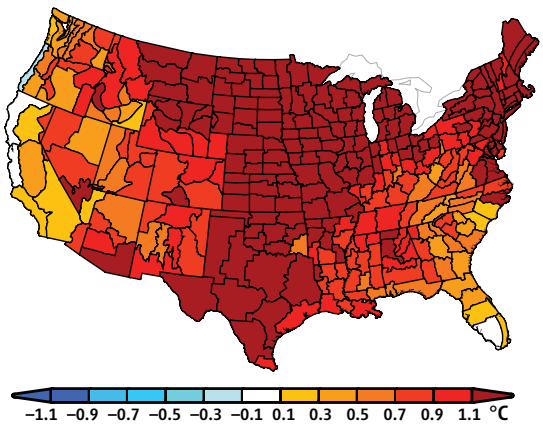
tributed. Because they had no prior examples of the recent run-up in greenhouse gases, the researchers were limited to analyzing simulations. They looked at 18 models that included greenhouse gases rising since the late 19th century to the present. Averaged over the models, the simulated greenhouse warming spanned the entire contiguous United States—much like the 2006 warmth, when every one of the lower 48 states was warmer than normal. The model average in 2006 accounted for "more than half of the observed warmth," the researchers report. "The record 2006 warmth was primarily due to human influences."



Warmth everywhere. All 48 of the contiguous states shared in the greenhouse-fueled warmth of 2006.

"I could come up with a slightly different conclusion," says meteorologist David Karoly of the University of Melbourne, Australia. Rather than blame half of the record warmth on the greenhouse, he would say that the new results show that added greenhouse gases have considerably upped the chances of a year like 2006. He agrees, however, that greenhouse gases made "a substantial contribution to the warmth of 2006."

Whatever the phrasing, the same greenhouse contribution is at work over the United States this year as last. But what are the chances that the natural jostling of the climate system will bring enough extra warmth to the year to set back-to-back records? It's possible, the NOAA group calculates, but not likely: The odds are only 16%. Still, the past spring was the fifth warmest on record for the contiguous United States. The heat is on again? **–RICHARD A. KERR**

using a property known as Kow, which indicates how readily a chemical dissolves in water compared with fat and thus predicts how easily it will move from a fish's blood lipids into water through its gills. Low-Kow, or more watersoluble, chemicals don't build up in the fish food chain and were assumed to be safe.

Environmental chemists realized, however, that this assumption might not hold in food chains involving mammals and birds because their lungs are in contact with air, not water. This means that many chemicals that are relatively soluble in water and therefore don't accumulate in fish might remain in the tissues of land animals if they aren't volatile enough to easily move from the lungs into the air (predicted by a property called Koa). Supporting this idea, some organic chemicals that don't biomagnify in fish appeared to be doing so in other wildlife and humans.

To explore this hypothesis, Gobas and graduate student Barry Kelly and colleagues collected plant and animal tissue samples—from lichens to beluga whales killed in Inuit hunts—in the Arctic, where, because of weather patterns and cold temperatures, organic pollutant levels are high. They tested the samples not only for known POPs but also for several chemicals with a low Kow but high Koa, which suggested they might biomagnify in air-breathing animals.

The measured levels of contaminants for various animals in aquatic and land food webs were similar to those predicted from a bioaccumulation model incorporating Koa and Kow, suggesting the model was correct. Chemicals with low Kow and high Koa stood out as potentially risky. Several of the contaminants studied, such as the insecticide lindane, have been proposed for the POPs treaty already. But many others with similar properties have not been scrutinized, Gobas says. The bottom line: "We're missing a lot of chemicals" that may be building up in the food web, Gobas says.

Canada and countries in Europe that are working through lists of industrial chemicals to identify new potential POPs will now need to revise their approach, says chemist Derek Muir of Environment Canada. He adds, however, that the model has limitations. For one thing, it assumes the chemicals aren't metabolized; many of them probably are, which may convert them to a form that is easily excreted. Procter & Gamble senior scientist Annie Weisbrod agrees: the Koa of chemicals "will matter in some cases," she says, "but the number of chemicals [that bioaccumulate] will not be a third of those in commerce." **–JOCELYN KAISER**

CREDIT: M. HOERLING *ET AL.*, *GEOPHYSICAL RESEARCH LETTERS* (2007)

Stem Cell Debate Reignites

The Stowers Institute for Medical Research in Kansas City, Missouri, has again delayed expansion plans because of opposition to research with human embryonic stem cells. Last fall, Missouri voters narrowly approved a measure to prevent the state legislature from prohibiting human ES cell work. But the thin margin of victory has prompted some opponents to try to overturn the measure in 2008. A proposed resolution in the legislature failed earlier this year, but Donn Rubin of the Missouri Coalition for Lifesaving Cures says he expects more attempts. "Missourians deserve the opportunity to vote to ban all human cloning," the Missourians Against Human Cloning said in a statement. Stowers says that the continuing controversy has scared off top recruits and put plans to double the institute's size on hold for now. **–GRETCHEN VOGEL**

Two Cheers for EIT

A key European Parliament committee gave its qualified blessing this week to the European Institute of Technology (EIT) proposed by the European Commission (EC). The EIT has met with little enthusiasm from scientists and industry (*Science*, 20 October 2006, p. 399), but some politicians are fans. Last month, relevant European ministers approved the idea, and now the parliament's Industry, Research and Energy panel has endorsed it, too. But the committee rejected the EC's plan to take the E.U.'s €308 million contribution to the EIT's €2.4 billion budget from existing innovation funds, calling also for an EIT pilot phase. The European Parliament will debate the plan in September. **–MARTIN ENSERINK**

Hot Times, Tough Sledding

A report released last week by the U.S. climate science program paints a murky but grim picture of the effort needed to cut greenhouse gas emissions. Three independently developed models of how that might be done came up with costs that varied by a factor of 8 and ranged to "substantial" levels, even with some optimistic assumptions. "Technically," stabilizing atmospheric greenhouse gases "is not impossible," concluded report author James Edmonds of the Pacific Northwest National Laboratory. Similar work summarized by the Intergovernmental Panel on Climate Change suggested that tackling the problem "is affordable," says economist William Pizer, of Washington, D.C.–based Resources for the Future, who said this report's "central tendencies" were "closer to the truth." **–RICHARD A. KERR**

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