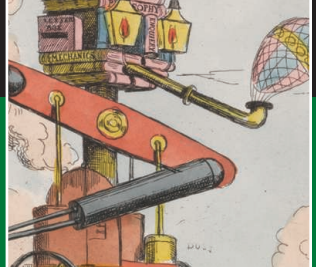


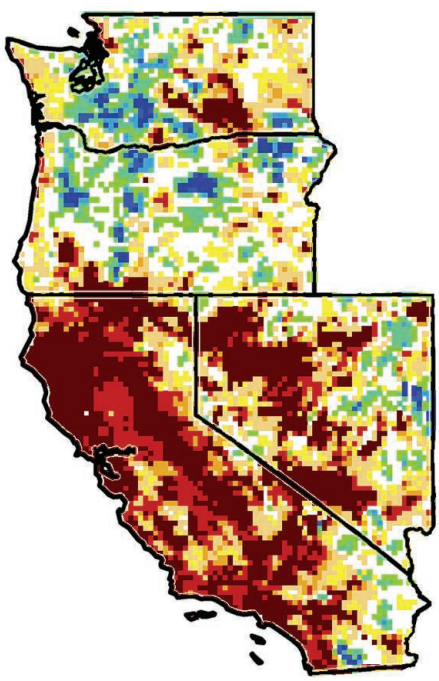
LETTERS

edited by Jennifer Sills

Australia's Drought: Lessons for California

MOST OF CALIFORNIA IS SUFFERING FROM AN extreme drought, and storage levels in the major reservoirs are well below historic levels. For the past several months, an unusually stubborn ridge of high pressure off the West Coast of the United States has been blocking normal winter storms and the rain they carry. California's history of drought has led to statewide strategies to save water, but Californian residents and policy-makers can do even more: They can look to the story of Australia's experience with a drought so intense and long-lasting that it was dramatically dubbed the Millennium Drought (*1*).

The Millennium Drought lasted from 1997 until late 2009 (*2*). Australia's economy and environment were hit hard. The drought accelerated the same trends facing farmers in developing countries worldwide: Small farms were squeezed out. Midsized farms were most vulnerable because they could neither achieve the economies of scale available to larger producers nor buffer losses with off-farm employment like the smallest farms could.



Dried out. As of February 2014, most of California is in Extreme to Exceptional Drought (see red and dark red areas on map).

Amazingly, despite blows to crop yields and livestock numbers, Australia's rate of growth in agricultural production has quickly returned to predrought trends. The impacts of this major drought on irrigation communities were buffered by some critical water reforms. These included: (i) well-developed water markets that allowed water trade to farmers in the greatest need; (ii) modernization of irrigation infrastructure that increased the efficiency of water delivery; and (iii) establishment of clear water entitlements for the environment that protected critical refuge habitats and populations as water availability declined.

The use of water markets was particularly critical. More than 40% of annual water allocations were traded at the height of the drought in 2007. For example, increased water prices allowed dairy farmers to sell their allocation and purchase fodder with the proceeds rather than irrigate pasture. Fruit growers and other producers who needed to maintain irrigation throughout the drought could purchase the dairy farmers' water to keep their operations viable.

In urban areas, strategies to increase supply and decrease demand were brought to bear. Expensive desalination and water recycling plants were built. Australians were more comfortable with the desalinated water (*3*, *4*), despite the recycled water's safety and the desalination plants' greater cost and large carbon and environmental footprints (*4*).

Between 2002 and 2009, per capita municipal water use in southeast Australia decreased by nearly 50% (*5*). Water use restrictions ranged from outright bans of conspicuously consumptive activities—such as daytime lawn watering and car washing—to rules promoting efficient water use—such as requirements for shutoff valves on hoses. Out of those temporary restrictions, permanent restrictions grew. Some areas in Australia still restrict daytime sprinkler use. Perhaps most relevant for worried Californians is how the Australian public received these changes. Studies cite an overall spirit of goodwill and cooperation fostered by the stress of drought (*6*).

The Millennium Drought brought about profound changes in Australians' conception of the environment, climate change, and water. The sticking power of those lessons and the success of the resulting policies and strategies will be tested by the next big drought. One lesson California can glean from the Australian experience is empowerment. Individuals making frugal water decisions can make a big difference in urban areas. Water markets and other measures that increase the flexibility of irrigation farmers in their response to drought can have big payoffs. Sustaining critical environmental water requirements will provide the basis for postdrought environmental recovery. A spirit of cooperation rather than contention can prevail even when tough decisions are made to address the needs of farmers and city residents.

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CREDIT: DATA FROM THE GLOBAL INTEGRATED DROUGHT MONITORING AND PREDICTION SYSTEM (GIDMAPS) (*2*)

Published by AAAS

Intestinal homeostasis

1439

Looking out

1440

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Drug Trafficking's Effects on Coastal Ecosystems

IN THEIR POLICY FORUM "DRUG POLICY AS conservation policy: Narco-deforestation" (31 January, p. 489), K. McSweeney *et al.* explain how Central American drug trafficking contributes to forest loss. Coastal ecosystems are also affected by drug trafficking.

Coastal drug trafficking is prominent along the Mesoamerican corridor (*1*). Shrimp and lobster fishing ports often double as trafficking centers, and small reef islands are occupied by narco-traffickers whose clandestine operations seed fear and corruption (*2*, *3*). Fishers get pulled into the drug trade, as they can make small fortunes selling supplies to traffickers, working directly with them, or by hunting the "white lobster"—bales of cocaine cast adrift by traffickers dumping evidence when capture is imminent (*2*–*4*). Drug traffickers also invest heavily in fishing fleets to help hide their operations, a narco-capitalization that could facilitate overfishing of high-value species such as shrimp or lobster (*4*–*7*). Money laundering also endangers coastal ecosystems through the development of often unregulated projects (e.g., building hotels) (*8*). The effect of these illegal activities on fisheries and coastal management is unquantified. As we study how "drug policy is conservation policy," let's not forget the coast.

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Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the past 3 months or matters of general interest. Letters are not acknowledged upon receipt. Whether published in full or in part, Letters are subject to editing for clarity and space. Letters submitted, published, or posted elsewhere, in print or online, will be disqualified. To submit a Letter, go to www.submit2science.org.

theBUZZ

Keystone XL

In her 21 February Editorial, "Keystone XL" (p. 815), Marcia McNutt endorses the Keystone pipeline, provided that the Canadians reduce greenhouse gas emissions (GHGs) from the extraction and production process, that a tax is imposed on the pipeline to make fossil fuels more expensive and support renewable energy, and that a successful review of the pipeline's environmental impact statement is completed. Many readers responded to her proposal. Excerpts from those comments are below. See all comments at http://comments.sciencemag.org/content/10.1126/science.1251932.

A selection of your thoughts:

…I think one of the key impacts of development of the Canadian tar sands that goes uncovered in the American media is on the lives, culture, and land of indigenous First Peoples in Canada …. [We] need to curtail tar sands development by whatever means the United States can marshal: economic, legal, diplomatic/political, environmental, and moral.

—Josh Foster

Poor argument. If this pipeline wasn't important to the further development of the tar sands, it's unlikely that the Canadian government would be putting so much effort into lobbying for the pipeline. …There should be better ways of mitigating climate change than blocking this pipeline, but the inability of our political system to make sensible policy in this domain leaves few alternatives. The idea that the Obama administration can use the Keystone pipeline to get the Canadian government to behave more responsibly is a delusion. There can be no responsible development of the tar sands….

—Roger Albin

…If readers of *Science* want to advocate conditions for allowing the pipeline to move forward, I suggest the following: Enact a carbon price that rises year-by-year to reach $50 or more per ton of carbon by 2030. Make it clear to investors that the carbon price will have to be paid for all the oil that moves through any pipeline, and that the pipelines must meet other criteria for environmental protection. Then let the market do what it will. But so long as we give fossil energy extractors a free pass to dump GHGs into the atmosphere with no constraint, we should hold the line on projects such as the XL Pipeline.

—Neil Leary

…I have yet to read how any of the opponents of the Keystone pipeline explain how eliminating it will have any impact at all on a bad Canadian decision and why the pipeline is worse than the methods that will be used to transport it–i.e., rail and truck. Perhaps canceling the pipeline might be some sort of object lesson, but this seems to me to be more in the feel-good category than a constructive one.

—Peter Geiser

Peter,… The symbolism of what we do can have profound impacts unrelated to the magnitude or even the direction of our actions. I'm particularly concerned if the symbolic consequence of our actions tips the balance unfavorably in other nations on the brink of making critical climate change decisions.

—Fred Moolten