

Hello, Governor

When California's governor enlisted the aid of two palaeoecologists, their careers took an unusual turn.

BY VIRGINIA GEWIN

Anthony Barnosky first thought the e-mail was a joke. As an expert in species extinctions who had just sounded the alarm over looming environmental crises, he had grown used to bizarre messages filling his inbox. There was the creepy e-mail enjoining him to “waste himself” to reduce carbon emissions, a plug for carbon-storing “biorocks” and a note encouraging him to explore “yogic flying” to help humanity. So Barnosky was understandably suspicious of the one-line request to contact California governor Jerry Brown. He wearily left a voice message at the number listed, apologizing if he had been spoofed. Out on a run later that day, his phone rang. Brown was on the other end.

It was June 2012 and Barnosky, a palaeoecologist at the University of California, Berkeley, had days earlier published a headline-grabbing *Nature* paper claiming that Earth faced a ‘planetary-scale tipping point’ because of human-caused climate disruptions, species extinctions, ecosystem loss, pollution and population growth¹. Among his co-authors was his wife, Elizabeth Hadly, also a palaeoecologist, at Stanford University in California.

The governor had seen the media coverage and had questions about the science but was particularly interested in the level of agreement within the scientific community. Barnosky says that the gist of the conversation came down to one question: “Why aren’t you guys shouting this from the rooftops?”

“We thought we were,” recalls Hadly.

Brown called a few more times before he made an unusual request: could Barnosky and Hadly translate the science into a format that

he could use in political circles — a consensus statement? They agreed, and with Brown’s help created a rallying cry of a report that has received more than 3,300 signatures of endorsement, the majority from researchers.

The document armed Brown with a powerful scientific rationale for the need to combat climate change, and he has handed the report to dozens of politicians, including US President Barack Obama and Chinese President Xi Jinping. Soon after, California entered into an agreement with China to cooperate on developing green technology and reducing greenhouse-gas emissions. And language from the report became part of a climate pact between California, Oregon, Washington and British Columbia, to base energy and environmental decisions on findings presented in the consensus statement as well as in the latest report from the Intergovernmental Panel on Climate Change.

Barnosky and Hadly say that working with Brown on the consensus statement altered their careers in ways they could not have imagined. It monopolized their time for much of a year, made them think much more practically about the relevance of their work and forced them to confront head-on the debate over whether scientists should step forward as policy advocates.

“The consensus statement is more valuable than anything else I’ve done in my career,” says Hadly. “We never could have guessed the reach this paper has had.”

TRANSLATING THE TEXT

Before the document could help to inform international negotiations, Barnosky and Hadly had to transform the seven-page paper they had written for scientists into a document aimed at world leaders, policy-makers and the public. Already on sabbatical to write a book, Barnosky took the lead in writing the 46-page statement. He and Hadly discussed



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JONATHAN SPRAGUE/REDUX/EYEVINE
Anthony Barnosky and Elizabeth Hadly in the laboratory.

write draft sections in intensive bursts and send them around to Hadly and the 14 other co-authors. The hardest part, he says, was summarizing the 126 cited studies — without using any scientific jargon. It took 21 iterations to nail down the wording.

This was new territory for them, but they had a guide. “Governor Brown taught us how to do this. He told us what kind of format he needed, not just to understand, himself, but to present to policy-makers,” says Hadly. Bulleted points were a must, as was a one-page summary up front. Brown wanted it classic looking, not flashy or cluttered. They went

the structure while working on it at night and weekends from their home in Palo Alto, California. Barnosky would

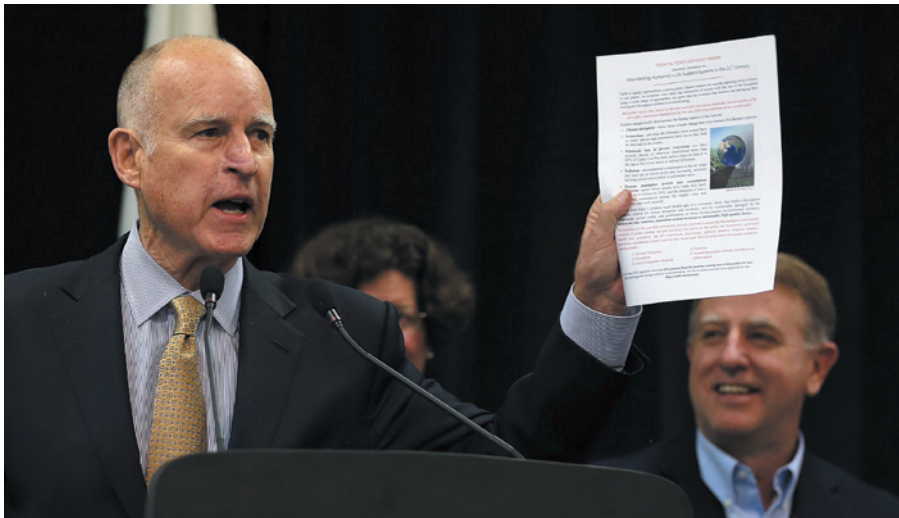
back and forth on formatting, even where to put the signatures. And the font was key. Brown wanted a simple clear font, Franklin Gothic, with the words ‘scientific consensus’ highlighted in red. But he confined his advice to style; he had no input on the content.

Once Hadly had put the finishing touches to it, the next step was to solicit signers. She and Barnosky made a list of global-change researchers they knew and sent a mass e-mail to them asking them to sign — and to pass it on to other relevant scientists. Within a month, the report had made its way to 41 countries and garnered 522 signatures. They were pleased with the response, but some people declined to sign because they did not agree with every sentence or, in particular, with the term ‘tipping point’.

Although there is little disagreement

that abrupt shifts occur in Earth systems, including climate and the composition of ecosystems, some scientists balk at the suggestion that there is enough evidence to predict a single tipping point for the whole planet. “I thought it was a great review of the evidence for rapid shifts in ecology, but then it switched to a series of unsupported statements — at best a hypothesis — about how a global tipping point in the biosphere could happen,” says Erle Ellis, a landscape ecologist at the University of Maryland, Baltimore County, who was involved in a response to the paper².

Yet Ellis understands why the term appeals to politicians. “It’s an extraordinarily simple way to look at human-induced global change. It effectively creates a binary Earth; a line drawn in the sand,” he says. “Doing



Governor Jerry Brown presents the consensus statement at NASA's Ames Research Center last year.

so gives a false sense of security on the 'safe side' and a false sense it is too late to act on the other." But the concept has power. In fact, game-theory simulations have shown that the kind of coordination needed to solve global environmental problems is much easier to achieve if a tipping point can be predicted with high certainty³.

So the feature of the paper that Brown, as a lifelong politician, instinctively responded to — the tipping point — was the hardest to sell to scientists. Hadly and Barnosky admit that it is a loaded term. But as researchers who study time periods written in layers of rock, they are used to coming across tipping points. The single scrape of a trowel can reveal, for example, signs of the abrupt extinction of nearly half the world's megafauna some 11,000 years ago. "The world looks different — the chemistry, biology, even the stratigraphy — for a long time after tipping points accumulate and extinctions take place," says Hadly.

To the authors on the consensus statement, the accelerating pace of change on Earth today is sending the planet towards a similar pivot point. They embodied that concept by commissioning Hadly's technician (also an artist), Lily Li, to create a computerized illustration of Earth teetering on the edge of a cliff, held back by a lone, stylized person.

AT THE PRECIPICE

Despite 8 months of work on the consensus statement, neither Hadly nor Barnosky came face to face with Brown until a warm, sunny May morning in 2013, when 400 business, government and civic leaders packed into a conference room at NASA's Ames Research Center in Mountain View, California, for a conference on sustainability technology.

The two scientists were out of their element, with Barnosky in a rarely worn suit and Hadly feeling a bit odd in high heels and a new purple dress. They presented the governor with the report, officially called

Scientific Consensus on Maintaining Humanity's Life Support Systems in the 21st Century. They also gave him a framed version of *Earth on the Cliff*. Brown pointed to the figure holding back the planet and asked who it was. Hadly replied: "It's you."

In his address to the crowd, Brown chastised the media for its anaemic coverage of climate change. He said that a different approach was required to achieve the critical mass needed to create change — something like the consensus statement.

"Governor Brown is a rare politician, as far as his own interest in science and his belief that science can help to persuade the public on climate change," says Susanne Moser, a climate-change communication consultant in Santa Cruz, California, who has worked with Brown on several issues.

As the report's roll-out continued, it was not uncommon for Barnosky and Hadly to receive urgent requests from Brown's office. One day they got a call asking for hard copies of the consensus statement that the governor could take to southern California for a meeting with President Obama and President Xi Jinping. They went to a printing shop, ran off two dozen copies, then Barnosky and his daughter drove the reports to Sacramento, a six-hour round trip.

In the thick of the release, Hadly and Barnosky spent up to half their time working on it. Hadly says that her efforts sparked several conversations with students, who were curious about how to take action without losing respect as a scientist. Conversely, outspoken population biologist Paul Ehrlich from Stanford was sceptical that anything would come of the statement; he had been involved in similar efforts in the past, and gained little political traction.

All along, Hadly and Barnosky have tried to walk a fine line between vigorous communication of the facts and outright advocacy for particular policies. They call their chosen

middle ground "information advocacy", saying that it offers politicians scientifically sound paths on issues but stops short of calling for a particular route. Last autumn, for example, they were asked to add their names to a list of 20 scientists, including Ehrlich and Ken Caldeira, an atmospheric scientist at the Carnegie Institution for Science in Stanford, who were sending an open letter to Brown requesting a ban on shale fracking for oil and gas in California. But they declined, saying that the message was too policy prescriptive. Hadly also turned down an invitation to advocate for research on bringing back extinct species.

"I respect their approach but I don't buy into the notion that prescriptive statements ruin my credibility," says Caldeira. "Everybody has opinions, and it doesn't do any service to science to keep those opinions secret."

Yet Hadly and Barnosky's approach seems to have worked for Brown, the leader of the world's eighth largest economy. Although calls with Brown's staff have slowed to a weekly check-in, the scientists are still working on getting the message out, most recently briefing California's legislative leaders on climate-change impacts and possible mitigation targets, and on their plans for future projects with the governor's office.

They also continue to champion the document outside the United States. Hadly has had the statement translated into other languages and Brown delivered it to political leaders in Norway, Japan, Mexico, Israel and Malaysia. On 4 June, she skyped into an event in Kathmandu during which members of Nepal's parliament signed the consensus statement, and pledged to address climate change as they draft a new constitution. "The thought that a government — particularly one squeezed in between China and India — is crafting a new constitution that hopes to build on these concerns is really powerful," she says.

Barnosky says that it would not have happened without Brown. "You can have all the consensus statements in the world, but what makes them effective is when somebody in a policy-making position actually uses them," he says.

For him and Hadly, the biggest lesson learned is that "a scientist's job isn't over once a paper is published", he says. Or, as Hadly puts it, scientists can reach a point in their careers when they decide, in a world of limited resources and time, to focus on making a difference. ■

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1. Barnosky, A. D. *et al. Nature* **486**, 52–58 (2012).
2. Brook, B. W., Ellis, E. C., Perring, M. P., Mackay, A. W. & Blomqvist, L. *Trends Ecol. Evol.* **28**, 396–401 (2013).
3. Barrett, S. & Dannenberg, A. *Nature Clim. Change* **4**, 36–39 (2014).