Southern Sierra Critical Zone Observatory

Media Coverage

1 July 2015 to 29 June 2016

1. *Plants and Animals Are Dying for a Drink: Four Years of Extreme Drought Taking Big Tolls.* Article by Tyler Hayden, Santa Barbara Independent. July 16, 2015.
   http://www.independent.com/news/2015/jul/16/plants-and-animals-are-dying-drink/
   Interview with C. Tague.

2. *Dying California forests offer a glimpse into climate change.* Article and video by Kim Brunhuber, CBC News. August 12, 2015.
   http://www.cbc.ca/news/technology/dying-california-forests-offer-a-glimpse-into-climate-change-1.3187672
   Interview with C. Tague.

3. *Talk about Forest Restoration*. Radio show by Tom Wiley, Down on the Farm, 88.1FM KFCF. September 4, 2015.
   https://www.facebook.com/KFCF881/posts/10155859324565391
   Interview and discussion with R. Bales.

4. *Watershed Connections: Forest Management and Its Impacts Downstream.* Article by Niki Woodard, Tulare Basin Wildlife Partners. October 14, 2015.
   http://www.tularebasinwildlifepartners.org/ow6-forest-management.html
   Interview with M. Safeeq, C. Hunsaker, R. Bales.

5. *Computer models aren't playing with fire.* Article by Lance Farrell, Science Node. November 9, 2015.
   https://sciencenode.org/feature/computer-models-arent-playing-with-fire.php
   Interview with C. Tague.

6. *The Secret Life of a Raindrop*. Article by Amy Miller. Video by Quest. KQED Science. November 10, 2015.
   http://ww2.kqed.org/quest/2015/11/10/secret-life-of-a-raindrop/
   Article and video feature SSCZO critical zone tree and National Critical Zone Observatory Program. Video also features interview with R. Bales.

7. *UW Researchers Discover Sediment Size Does Matter in High-Elevation Erosion Rates.* Article by University of Wyoming. November 16, 2015.
   http://www.uwyo.edu/uw/news/2015/11/uw-researchers-discover-sediment-size-does-matter-in-high-elevation-erosion-rates.html

Research summary of Riebe et al., 2015, and interview with C. Riebe and C. Lukens. Article reprinted in Science Daily.

8. *Amid Severe Drought, California Snowpack Hits 5-Year High*. Radio show by Jeremy Hobson, Here and Now, 90.9 FM WBUR. January 27, 2016.
http://www.wbur.org/hereandnow/2016/01/27/california-snowpack-5-year-high
Interview with R. Bales.

9. *Let It Snow! The Science of Winter*, National Science Foundation Special Report. January 13, 2016.
http://www.nsf.gov/news/special_reports/snow/
Features previously published article about SSCZO, *A Tree Stands Tall in the Sierra Nevada*. Article by Cheryl Dybas, National Science Foundation. August 7, 2012.

10. *New report explains ancient phenomenon known as "winter".* Article by Suzanne Jacobs, Grist. January 14, 2016.
http://grist.org/article/new-report-explains-ancient-phenomenon-known-as-winter/
Coverage of National Science Foundation Special Report *Let It Snow! The Science of Winter*.

11. *Prospects Dim for Drought Relief as California Snowpack Falls Below Average.* Radio show by Michael Krasny, KQED Forum, KQED Radio. March 3, 2016.
http://ww2.kqed.org/forum/2016/03/03/prospects-dim-for-drought-relief-as-california-snowpack-falls-below-average/
Interview and discussion with R. Bales.

12. *Sierra Nevada Snow Won't End California's Thirst*. Article by Henry Fountain. Photos by Jim Wilson. The New York Times. April 11, 2016.
http://www.nytimes.com/2016/04/12/science/california-snow-drought-sierra-nevada-water.html
Interview with R. Bales, M. Safeeq, and M. Conklin. Photos also include E. Stacy.

13. *Losing snow in a changing climate: What global warming means for our water supplies.* Article by Ian James. Photos and video by Jay Calderon. The Desert Sun. April 13, 2016.
http://www.desertsun.com/story/news/environment/2016/04/14/climate-change-snowpack-water-supplies/82631192/
Interview with E. Stacy and M. Thaw. Article reprinted in USA Today.

14. *Under Where? Underground Water and Its Contribution to Streams*, in Natural Inquirer Freshwater, *18*(1).
http://www.naturalinquirer.org/Underground-Water-and-Its-Contribution-to-Streams-a-169.html
Features article about research methods and findings from Liu et al., 2012; classroom activities based on research; and researcher profiles for F. Liu, C., Hunsaker, and R. Bales.

CLIMATE CENTRAL

Researching and reporting the science and impacts of climate change

Dead Trees Adding to California Firefighters' Battle

Published: June 22nd, 2016
By John Upton

With drought and climate change conspiring to push California's summer wildfire season into premature overdrive, the state's lead wildfire agency has acquired a multimillion dollar arsenal to help it cope with unprecedented numbers of dying trees.

California recently bought $6 million worth of chippers, mobile sawmills, portable incinerators and other equipment to help its firefighters remove some of the nearly 30 million trees that now stand dead across the state, killed by drought and insects.

A firefighter from Chino Hills keeps watch on a wildfire as it burns near Potrero, Calif.
Credit: REUTERS/Mike Blake

The equipment is being used as parched southern California landscapes explode in the types of summertime flames that wouldn't normally be expected until August. Grasses that fattened up following winter storms in central and northern California are expected to fuel major blazes in the weeks ahead.

"The more time that goes by, the dryer the fuels are going to become," said Tom Rolinski, a U.S. Forest Service meteorologist who forecasts fire conditions in southern California. "As this summer unfolds and we get into the August and September timeframes, the fuels are going to be that much dryer, and we're probably going to see more intense fires."

The California Department of Forestry and Fire Protection, normally called CAL FIRE, which is charged with protecting tens of millions of acres of mostly private land, responded to about 250 fires last week — an unusually large number for mid-June.

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Warming Is Increasing Wildfire Risks in California
Wildfires Tied to Drought, Heat & Topography, Not Beetles

On Tuesday, CAL FIRE was working with other agencies to try to contain two major blazes in southern California as firefighters in other southwestern states also battled big fires amid record-breaking heat.

The fires are being fueled by droughts exacerbated by warming temperatures, which scientists have linked to climate change and to the natural whims of the weather.

"Warming causes fuels to be drier than they would otherwise be," said Park Williams, who researches ecology and climate change at Columbia's Lamont-Doherty Earth Observatory. "Whether that corresponds to a large area burned for California this year will depend on human activities and individual weather events."

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Large fires currently burning in the U.S.
45

Even as firefighters in California toil to battle the extraordinary blazes, they're being forced to deal with another extraordinary phenomenon: the widespread dying of trees.

About 30 million trees across the state are estimated to have died, succumbing to attacks by beetles because of the weakening effects of drought.

"It's the drought that sort of sets it off, and then it lets the beetles get out of hand," said Roger Bales, a professor at the University of California, Merced.

Gov. Jerry Brown declared an emergency in the fall because of the unprecedented die-offs, helping to free up funds needed to remove and dispose of some of them. CAL FIRE hired hundreds of seasonal workers early this year to help remove dead trees and clear out other potential fuel for fires.

While ecologists value dead trees as natural assets that provide holes and logs needed by wildlife, firefighters view them as safety hazards that can crash down on roads, power lines and homes and that could potentially fuel bigger blazes.

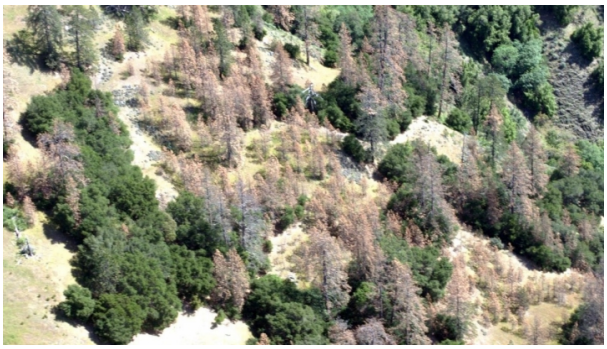
The "scale of this tree die-off is unprecedented in modern history," Brown's emergency declaration stated, worsening wildfire risks and erosion threats and creating "life safety risks from falling trees."

A group of ecologists formally objected to the emergency declaration, arguing in a letter to Brown that dead trees are natural and necessary parts of Californian landscapes. They pointed to a growing body of research downplaying the wildfire hazards posed by trees killed by beetles.

One of those ecologists, Chad Hanson, director of a small California nonprofit, says he agrees that dead trees that pose falling hazards should be removed. But he said trunks should be left on the ground to provide habitat instead of being incinerated or removed. "Once you fell the trees, they're no longer a hazard," he said.

Summertime fires in California cause less property damage than the fires that are fanned by dry Santa Ana winds in the fall and winter, but they sap more firefighting resources, research published last year showed.

"We were really trying to figure out how fires will change in southern California in the future," said James Randerson, a University of



Dead pines photographed during an aerial survey last year in Los Padres National Forest.
Source: U.S. Forest Service

California, Irvine earth scientist who contributed to the study. “What we realized early on is that there are two distinct fire types.”

While the effects of climate change on Santa Ana winds fires remain riddled with uncertainty, scientists are generally convinced that the parching effects of global warming will lead to bigger, longer and more damaging summertime blazes in California — if they aren’t already doing so.

That suggests the intense and early summer fire seasons in this and other recent drought-stricken years may have been less an aberration and more a bellwether of something that CAL FIRE officials frequently describe as a “new normal” for firefighters.

With more greenhouse gas pollution piling into the atmosphere daily, continuing to warm the planet toward a 2°F increase from preindustrial times, and with warmer weather exacerbating droughts, mass tree die-offs could become routine features of Western landscapes.

Not only would that eliminate or shrink some forests, driving them northward or uphill toward cooler climates, it could also force increasingly overworked firefighting agencies to juggle the additional routine task of managing dead trees.

CAL FIRE is focusing its tree removal efforts in areas where most trees have died and where the dead trees pose the most immediate dangers.

“We’re focused on high hazard areas with the greatest threat to life safety and critical infrastructure,” CAL FIRE spokeswoman Janet Upton said. “There are literally hundreds of thousands of acres, and growing, affected by the unprecedented scope and magnitude of tree mortality.”

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Courtesy Jeff Head.

Computer models aren’t playing with fire

Six of the last 11 years have seen more than eight million acres (3.2 million hectares) burned in the US. To combat these infernos, the modern firefighter looks to computer models, like those provided by the US National Center for Atmospheric Research (NCAR). There's much these models can tell, and much they can't.

Speed read

- Global warming is increasing the number of wildfires.
- Firefighting in 2015 looks to computer models for help — before, during, and after a wildfire.
- Computer models are a great help, but not infallible.

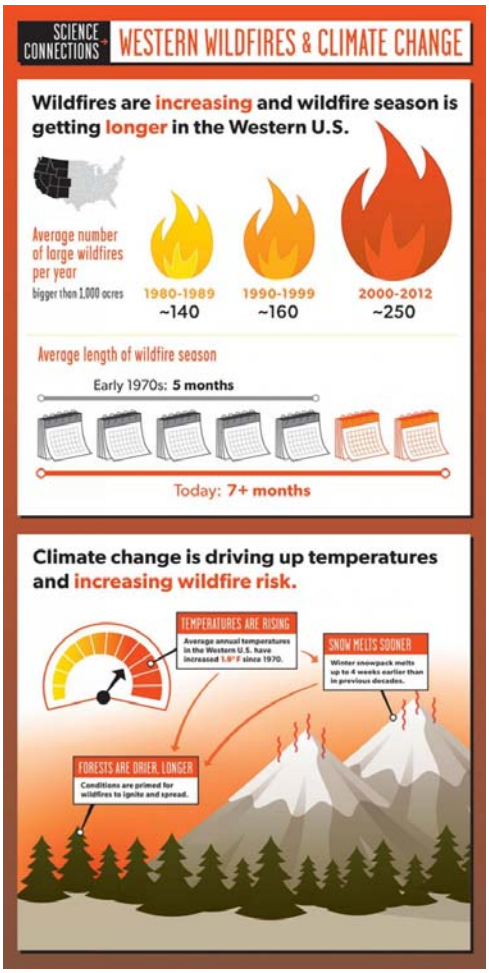
Posted on 09 NOV, 2015

The western United States is on fire. Again.

Frequent wildfires have become the new normal, up

Frequent wildfires have become the new normal, up by 78% since 1970. In six of the last eleven years, fires have consumed more than 8 million acres (3.2 million hectares), with 2015 on pace to set a new record. 65 fires remain unchecked, and the toll is still rising.

The spike in wildfires is attributed to global warming; temperatures in the western US are rising at double the pace of the global average. By 2070, the US National Center for Atmospheric Research (NCAR) predicts the number of days over 95° Fahrenheit (35° Celsius) will quadruple.



Courtesy Union of Concerned Scientists.

Rising temperatures mean earlier snowmelt, leading to drier conditions and hotter temperatures that leave forests vulnerable to even a spark. Nine out of

Lance Farrell
US editor

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10 times this spark comes from a human source (lightning and lava flows still account for a small percentage), which firefighters then have to battle for weeks at a time.

Outsmarting the wildfire

Armed with hoses, trucks, and helicopters — and of course lots of water —modern firefighters now also have computer models at their disposal. By predicting where a fire will be and how fast it will get there, models help firefighters allocate resources strategically.

A new type of model offers more precise predictions, such as when a fire will accelerate or produce fire whirls. It can calculate when downdrafts from a cloud might cause a change in fire direction or intensity, or how airflow coming down from a mountain might cause a fire to grow in oddly shaped patterns.

NCAR scientist Janice Coen has developed two such models. Funded by the US National Science Foundation (NSF), NCAR aims to understand the dynamics between the atmosphere and fire.

"Fire modeling is actually a weather modeling problem," says Coen. "The greatest challenges are the same — trying to model airflow correctly in complex terrain and, in addition, battling the buildup of errors that is an unavoidable part of weather forecasting."

Weather prediction models consist of fluid dynamics equations based on, among other things, laws of mass conservation, thermodynamics, and motion. Coen's models assume a fire is affected by natural weather conditions, while also recognizing that a fire creates its own weather. As fire blazes across acres it releases heat into the sky, pulling air from behind and creating winds that literally fan the flames.

> ***Fire modeling is actually a weather modeling problem. You can be pretty confident about the weather forecast you are given for tomorrow, while the forecast for several days from now may be less good.***

Tools of the trade. *Firefighters battle fires for weeks on end, and use a variety of tools to douse the flames. To allocate resources wisely, many fire departments now look to computer models which can tell them when and where a fire will spread. Courtesy US Bureau of Land Management and the US Forest Service.*

Wildfire models cannot predict which burning embers lofted ahead of the fire will light the would-be tinder on which they land. And, like any tool that tries to predict weather, fire-spread models are not infallible.

"You can be pretty confident about the weather forecast you are given for tomorrow, while the forecast for several days from now may be less good, and the one for the next week may not have any predictive value," Coen notes. "My models depict airflow at very fine scales, and these lose value very quickly — they may be useful only for a day or two. To increase their longevity, my current work injects data into the running model."

Living with fire: forest management before the blaze

While Coen's models of fire behavior help support fire fighting during a fire, Professor Christina Tague's models look at how fire risk changes over time and space. Tague, of the University of California, Santa Barbara (UCSB), is investigating whether land management can reduce these risks before the fire starts. Tague's work builds on the Regional hydroecological simulation system (RHESSys), an open-source software portal with over 75 algorithms that represent how water, climate, fire, vegetation and soil interact over space and time.

Her NSF-funded approach links a social science

model to improve understanding of the biophysics of fire and its effects. Tague and her collaborators will integrate models of forest growth, fire risk, and hydrology with models of how pre-fire forest management decisions are made. This combination will help them assess the potential of fuel treatments like thinning a forest, removing fallen trees, leaves, branches, and other understory vegetation that act as ladders that fires climb into the tree canopy.

Tague's wildfire model offers two advancements. First, it adds a sophisticated representation of the water cycle that can investigate the impacts of both fire and fuel treatments on water—how it is used by vegetation and how much ends up in streams. Wildfires can significantly change the water supply by altering vegetation and soil characteristics. They can also impact water quality by increasing soil erosion. Before fires, how much water is available for vegetation can be an important indicator of fire risk. Water and fire are closely linked and Tague's NSF-funded model will capture these interactions.

In addition, her model provides insights into how management decisions affect fire risk. "There are many factors that determine when and where fuel treatments are done. For example, when there has recently been a fire, the risks of fire are fresh in the public mind, and this can lead to pressure for

Living with fire. *Wildfires have increased by 78% since 1970. Cost can be measured in terms of property, lives lost, displacement, and destruction of habitat. Christina Taque recently won an NSF-grant to see if practices like forest thinning and removing ground materials helps or hinders the fight against wildfires. Courtesy Jeff Head.*

responses from public institutions. We don't really know if this is an efficient use of the often limited funding available for fuel treatments," Tague says.

As high-performance computing (HPC) advances, so too does the ability to predict the weather and how to fight fire and strategically manage landscapes where fires will continue to occur. HPC enables researchers to include larger amounts of atmospheric and land surface data, at increasingly finer resolutions, and to explore the implications of many different scenarios. HPC also bestows an ability to integrate disparate models and multiple algorithms to offer comprehensive and more predictive firefighting and fire risk management tools.

We may always have to live with wildfires – but with the better modeling that comes from HPC, we may

reduce the risks to things we care about.

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Do you have story ideas or something to contribute? Let us know!

FUNDING PARTNERS

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Dying California forests offer a glimpse into climate change

Experts say effects could be worse in Canada

By Kim Brunhuber, CBC News Posted: Aug 12, 2015 3:20 PM ET Last Updated: Aug 17, 2015 8:47 AM ET

Forestry researcher Nick Ampersee chops into the pine with his axe and removes a slice of bark. The inside looks as though it has been slathered with white-out.

"Mycelia," he says. "That's a fungus. It usually weakens the tree and then something like a bark beetle will finish the tree off."

Another researcher cuts into a different tree with her knife and shows me what looks like a couple of over-boiled grains of rice.

"We are dealing with some weevil activity here at the base," she says. The tree doesn't have long to live.

- **Photos: Drought-ravaged California seen from above**
- **California's drought offers Canada lessons in crisis prevention**

Every year over the last decade and a half, the U.S. Geological Survey has descended on Yosemite and Sequoia National Parks in California to give 17,000 trees a physical. But in a growing number of cases, what's starting off as a check-up is turning into an autopsy.

The cause of death is usually insects or fungus, but researchers suspect it's almost always because of one culprit: lack of water.

Normally, only about two per cent of the trees in their study areas die. But this year, that number has grown to 13 per cent.

"That's a really severe uptick," says U.S. Geological Survey ecologist Nate Stephenson. "We've never seen anything like it before."

Stephenson bends the branch of an incense cedar. Most branches are covered with dry, dead orange needles. The rest are bare.

"I used to call them 'the immortals,' because they just never seemed to die," he says. "In the fourth year of drought, they've started dying by the bucket-loads. So they're no longer the immortals."

Warming temperatures to blame

Stephenson has surveyed some of the oldest, richest forests in the U.S. and British Columbia. Compared to just a few decades ago, he found that the trees' death rate has doubled from one to two percent. It may not sound like a lot, he says, but he says imagine if you were talking about your hometown.

"If you looked back and saw that death rates had doubled, you'd really wonder what was going on," Stephenson says. "The one thing that really stood out is warming temperatures. We think that's what's driving the increase in tree death rates."

For the past four years, California has been going through a record-setting drought. In January, the state's governor, Jerry Brown, declared a state of emergency.

In June, Naomi Tague of UC Santa Barbara published a study in the journal New Phytologist on die-off in California forests that found that 12 million trees died due to drought this year alone. Tague, who is Canadian, says the hot, dry weather has been great for the insects and bad for the trees.

While the situation in California is dire now, in the future, Canadian forests may be at greater risk, even if the drought is less severe.

"The trees [in California] are used to drought, and so you have to get this severe drought before you start to see this die-back," Tague says.

"But you can imagine that a spruce forest in the boreal part of Canada, it's not used to seeing drought. So it hasn't developed the same types of defensive mechanisms to insects."

Canada's boreal forest, which stretches across the north of the country, is one of the world's largest intact forests. According to Tague, it may be particularly vulnerable as you move further north.

"The increase in temperature is greater at greater latitudes," Tague says. "A cold drought is not the same as a warm drought."

Their research has found that no tree seems to be immune, including the toughest, most drought-resistant trees in this forest: giant sequoias.

Some of the trees in Sequoia National Park were a thousand years old when Julius Caesar crossed the Rubicon. Last year, Stephenson spent a few days crawling around the forest floor examining sequoia seedlings, convinced they'd be affected by the heat and the drought.

"They all looked really happy," he says. "I sat back, scratched my head and looked up, and there was a huge adult giant sequoia that had a lot of foliage die-back in it. That really got us interested, and we figured the drought was probably the cause of that. And that created a cascade of studies."

They found that a significant number of older trees that had shrugged off the Dust Bowl in the 1930s were losing as much as half of their leaves.

"Ten per cent of the trees had 25 to 50 per cent die-back," says Koren Nydick of the U.S. National Park Service. "This is the first time that this kind of foliage die-back has been observed since this has been a national park."

Aiming for answers

To determine the exact extent of the problem, a small group of scientists is going to extreme -- and dangerous -- lengths.

Diagnosing dead trees (footage courtesy of UC Berkeley researchers Wendy Lloyd Baxter and Anthony Ambrose)

Anthony Ambrose, a tree biologist currently working in the Department of Integrative Biology at UC

Berkeley, aims his crossbow at the uppermost branches of a huge sequoia, fires... and misses.

"That was the perfect shot," Ambrose says ruefully. "It just dropped short."

Ambrose has to shoot an arrow with a line attached over a branch so far away you need a spotter to track it. That's the easy part. Next, he has to hoist himself by hand more than 80 metres up into the canopy to collect samples and take measurements.

"This tree here is in an area that has been exhibiting signs of severe crown die-back, so we wanted to characterize the trees in this part of the grove to see how stressed they are, and compare them with trees in areas that aren't affected by the drought," Ambrose says.

If there's a positive from this tree-killing drought, it's this: for Ambrose and his team, it's literally a dry run. A chance to improve their models in order to better predict what will happen in North America when this hotter, drier climate is the norm.

"This tree here is maybe a thousand, maybe two thousand years old," Ambrose says, looking at the next giant sequoia he's about to climb.

"It's dealt with severe conditions, extreme droughts, fires in the past. They're really resilient trees, but every species, every organism, has a limit, and in the future, there may be a point where drought impact becomes so severe that they shed all their foliage, they stop growing. Maybe at some point, they get susceptible to insects or disease, and start to die back."

Corrections

- A previous version of this story wrongly attributed quotes about the health of giant sequoia trees to a United States Geological Survey biologist named Adrian Das. The person who actually said these quotes is Anthony Ambrose, a tree biologist currently working in the Department of Integrative Biology at UC Berkeley. The error has been corrected in the text.
  Aug 13, 2015 11:15 AM ET