The consequences of spraying fire retardants on wildfires

September 14 2020, by Genevieve Rajewski

Fire retardants being sprayed from a jet. “These fire retardants haven’t been fully studied over long periods of time at the increased amounts we’re currently using,” says Jordyn Ellorin. Credit: Gary Tabor

Wildfires started burning in California early again this dry season—more than two million acres have burned so far. Larger and larger wildfires are

occurring as new heat records are being broken each year.

Firefighting efforts have leaned heavily on aerial spraying of fire retardants, but their environmental and health effects are little studied, says Jordyn Ellorin, VG19, a native Californian who received an M.S. in conservation medicine (MCM) from Cummings School of Veterinary Medicine.

For the capstone requirement of her master's program, Ellorin focused on the sustainability of current methods for fighting wildfires in California. (She now works as an animal diet technician for San Diego Zoo Global, where she did her MCM externship.)

Tufts Now talked to Ellorin about what she learned about wildfire management and mitigation—and the consequences of those efforts.

Tufts Now: Does the use of these long-term fire retardants in California seem to be increasing?

Jordyn Ellorin: I can't speak to what is occurring with this round of fires. However, I can tell you from my research that the safety and usage guidelines for the fire retardants were developed nearly forty years ago. And the research that informed those guidelines was based on the amounts of chemicals that they were spraying back then, not at these increased amounts we see now.

The California Department of Forestry and Fire Protection (CalFire) and the U.S. Forest Service (USFS) publish an estimated budget each year that contains the amount of flame retardant that they expect to use during the next fire season based on previous years and label-use specifications of the products. At the end of the year another report is published stating the amount of fire retardant actually used. These

reports show that the actual use exceeded the anticipated amount for all years since 2014.

Why is that?

It's due in part to larger wildfires that are occurring as new heat records are being broken each year and from climate change and humans further encroaching on wildland areas.

The use of long-term fire retardants is designed to slow the fire ahead of ground crews so they can access and gain control of the fire. But fire retardants are now being used instead of ground crews, according to Firefighters United for Safety, Ethics, and Ecology (FUSEE), and the 19 million gallons sprayed on California's federal lands is being applied differently than originally intended.

CalFire and USFS are not supposed to spray retardants within 300 feet of any waterway for environmental health reasons. However, there's an addendum to that rule that says you can spray near any waterway if human life or property is in danger.

In recent years, more people are living in forested areas, areas between urban and wild habitats, and other places where there is a fuel load for wildfires. So now there's a need to spray retardants in areas where they traditionally wouldn't have been allowed—and then downstream effects from that.

What are the downstream effects on animals?

The really worrisome aspect is that we don't truly know. These fire retardants haven't been fully studied over long periods of time at the increased amounts we're currently using.

We do know that sprayed fire retardants feed harmful algal blooms along waterways and are toxic to fish. A 2014 study showed that the active ingredient in one common sprayed fire retardant is toxic to chinook salmon, causing death from direct exposure, as well as gill damage that would lead to reduced ocean survival at even dilute amounts. This is concerning, as salmon populations are a major contributor to the California river and ocean ecosystems and already in jeopardy as a native species.

On a larger scale, studies in the Canadian Arctic have shown that brominated fire retardants, which are now banned, accumulate in food systems from fish to wolf.

Until recently, these retardants were commonly used in close-contact household items such as furniture, so their effects have been better studied. It demonstrates the potential for exposure to fire retardants to create ripple effects in the environment and wildlife far from where they are first used.

And what about the effect on people?

On the human side, the chemicals' material safety data sheets say that the retardants are not toxic to people but should not be ingested. The retardants are dyed orange so that when people see them come out of the planes, they know they shouldn't eat any food from their garden.

However, things can get tricky if your garden is sprayed while you're evacuated, because the fire retardants turn clear once exposed to sunlight. Meanwhile, California supplies more than two-thirds of the nation's fruit and vegetables.

The U.S. Geological Services has a group, Columbia Environmental Research Center, that is working to pull together longitudinal research on

effects of these fire-retardant chemicals. But there is currently nothing published on their effects on California's agricultural products.

Human health researchers also have expressed concern that, although there is published research about the human hazards of smoke inhalation from wildfires, little is known about the inhalation of fire-retardant chemicals once they're burned off by wildfires.

Can spraying fire retardants actually create more fuel for fire down the road?

One of the main components of most fire retardants is ammonium phosphate, which is a basic plant multi-nutrient fertilizer. When we essentially spray a fertilizer over California, so-called invasive plant species grow faster and outcompete the state's native plant species, which do not thrive in a fertilized environment.

The non-native plant species then flourish in California's wet season. And when this season changes to a very dry summer, there is a lot of dead brush or dead plant material that creates the fuel load for wildfires.

How can California adapt to prevent these dangerous fires before they start?

That is the key question. Fires are environmentally necessary. They burn dead or dry brush and other plant material first, clearing the forest and allowing space and light for new plants to thrive. Within some ecosystems, fires influence seedling germination, forest structure, and soil composition. They are how many wild plants seed and regrow, so they're important for the state's native species.

But if we're spraying fertilizer and all these non-native species are

coming up and outcompeting the native species, how do we stop that cycle from feeding these huge wildfires? My case study while I was at Cummings looked at two potential mitigation tactics: prescribed fires and grazing.

Pine needles and other dry plant material burns hot and fast and, at a small level, that's okay. You want that dry plant material to burn and replenish the nutrients into the soil. But if too much of it burns, it starts catching the trees on fire. Once the trees start burning, the fire becomes super-hot and starts moving really fast. That is hard to stop.

California doesn't really have the human resources to safely conduct enough small controlled burns to thin that potential fuel load. And in the dry summer months, you don't want to conduct these prescribed fires, because that's when things can get out of control.

What about grazing—is it a more feasible mitigation measure?

You don't want to graze those native plant habitats that are really vital to our state. But grazing could be a useful mitigation tactic in hilly or mountainous areas. Firefighters have a really hard time fighting fires on hills because they can't get trucks in there and fires tend to move up and down hills very quickly. So using livestock animals that are able to climb up and down those hills and graze and clear the ground of dead brush and plants would be helpful.

Goats may be a little bit less detrimental to the environment. You need fewer of them to browse an area clean, as they eat many different types of plant material when compared to cattle. They're also not quite as heavy as cattle, so they don't till up the ground quite as much as cows do. However, grazing is still a measure that has to be undertaken carefully,

as domestic animals still will eat native plants that wildlife could be eating.

The USFS already leases land to agriculture professionals for grazing purposes, but this approach to land use could be further utilized to holistically benefit humans, animals, and the environment.

It sounds like there are competing interests at issue here—people's safety and their property versus wildlife and the environment.

Growing up in northern California, I had experienced "fire season," but within the last 10 years, every fire season has been labeled "unprecedented" and devastating to larger populations of the state. I think now that the majority of people living in the state have experienced the panic of evacuating or are related to someone who has.

It's hard to balance people feeling safe where they live and knowing how human actions are affecting the environment they live in. Further studying the effects of what we are doing currently will give people a better idea of humans' impact and the opportunity to come up with innovative solutions for fire management.

More information: Wildfires, Fire Retardants, and Wildlife: A review on the usage of California fire retardants and their One Health effects: storymaps.arcgis.com/stories/c … 4fe59ca1e36b2a585048

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