Forest at Grampians National Park, Victoria. Credit: Heru Handika.

What Could Recovery Look Like for Blazing Australia?

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LSU Researchers Discuss Impacts Wildfires will have on Australia's Ecosystems and Future

Lightning strikes have left much of Australia's eastern coast in a fiery blaze dated as far back as September of last year. In the months following, the country has faced the worst loss of land and animals its seen in recent decades.

With the world watching and doing all it can to support the cause, we wanted to get a better perspective on how the fires have gotten to this point, the impacts they will have on the environment and ecosystems, and what the recovery process could look like.

How have wildfires become a global threat?

It's no secret these fires are unlike any others we've seen in terms of location, destruction, and endurance. Just in this past year, we've seen geologically diverse landscapes like California and the Amazon Rainforest experience severe fires. Environmental and human factors have created conditions that have turned what should be a natural process into a natural disaster.

One human aspect is something Dr. Kyle Harms, ecologist and evolutionary biologist in the LSU Department of Biological Science, explained as ecosystem loss and fragmentation. By clearing and using land for farming, roads, cities, buildings, parking lots, etc., we are reducing natural habitats. In the process of building these things, humans have also fragmented ecosystems.

"Let's say there's a habitat patch, and we build a road through it. So,

the road itself reduces the size of that habitat, and also fragments it into two, so what was once an intact population of some key species is now split in two populations, each half the size or smaller," explained Harms.

This is important as we know that population sizes are closely tied to extinction risks but also when it comes to disturbing the natural process of fires maintaining ecosystems.

"Fires themselves are not always a bad thing," he explained. "There are ecosystems around the world that burn, and for a very long time, would burn frequently, like every couple of years. For example, here in the southeastern U.S., the pre-human colonization natural fires wouldn't burn up everything; these are what we think of as cool ground fires that burn the aboveground biomass— shrubs, fallen limbs, leaves, etc.— on the ground, but don't generally burn up all the trees."

In this case, fires are just part of the natural order of things: a natural maintenance process, or if used by humans, a maintenance tool, if you will. It's like when there is an overpopulation of deer in an area and hunters are called in to bring the population back down to a manageable size. However, the problem now is that this natural occurrence is disturbed not only by our reduced and fragmented ecosystems but also by our fire suppression.

"If you have two housing developments and some wild lands in between, you're going to suppress that fire in between the developments and it's not going to get as much frequent fire," Harms explained. "So it should be a natural process and a natural part of the landscape, but you've now got areas that have extreme buildup of wood and the biomass that is the fuel for these fires, so once the fire

ignites, it causes an extreme situation, one that's sort of beyond what nature usually experiences."

Forest at Mt. Macedon, Victoria, Australia. This was after a prescribed burning. In Australia, they do seasonal prescribed burnings to reduce the "fuel" accumulating in the forest to prevent wild fires during dry seasons. Credit: Heru Handika.

Harms along with Dr. Cassandra (Cassie) N. Glaspie, assistant professor in the Department of Oceanography & Coastal Sciences in the College of Coast & Environment; Dr. Jake Esselstyn, associate professor in the LSU Department of Biological Sciences who studies evolutionary history of small mammal; and his Ph.D. student, Heru Handika, agree on the role climate change has played in the cause and intensity of the fires.

"The climate is getting warmer and a lot of ecosystems are drying out—it's affecting places that either didn't normally burn or that burned in the past, but with lower intensity," said Esselstyn.

Glaspie studies changes to coastal food webs in Australia and considers climate change to be a factor not just in the Australian wildfires but to the Brazilian and Californian fires, as well.

“Fires are happening all over the world at the same time,” she noted. “These are different hemispheres that you would think would be completely out of sync with one another when it comes to fires, but we’re not really seeing that. We’re seeing fires happen for long throughout the year around a much larger portion of the globe, which indicates to me that climate change has something to do with it.”

How is this affecting Australia’s ecosystems?

Potential Species Extinction

Harms, Esselstyn, and Handika, who recently earned his master’s degree from the University of Melbourne in Australia, agree that one major issue the fires are posing is the possible extinction of species that cannot be undone.

“Like we talked about earlier with habitat reduction and fragmentation, maybe there’s just one little refuge that is the species’ last holdout, and if it burns, there’s no opportunity for recolonization from somewhere else; well that’s it, and the extinction is final,” said Harms.

This is not only true of discovered species but also for unnamed species that could potentially be lost to science with no record of them even existing.

“This could alter a fundamental level in the food chain for a lot of animals, or birds or mammals or lizards, and so that’s going to have

cascading effects," said Esselstyn.

However, Esselstyn and Handika explained that some species will adapt to the fires better than others and have a higher chance of survival.

Swamp Wallaby, a native marsupial to Eastern Australia. Taken at Healesville Sanctuary, Victoria, Australia. Credit: Heru Handika.

While at Melbourne, Handika was involved in fieldwork for a study his advisor, Dr. Kevin C. Rowe, and his then-Ph.D student., Dr. Phoebe A. Burn, were conducting on a species called the smoky mouse (no pun intended). Part of their research involved surveying the Victoria Valley Range in Australia for the species after a severe fire in 2013 to see if—and how well—the species prevailed.

The study indicated that the species persisted in the same locations for at least 21 months after the fires, which was in stark contrast to many other small mammal species that were not recorded from the burned area for years after the fire.

"For some reason, this species found a way to survive the fire," said Handika. "Although, their population remains small being we only recorded one to a few individuals per survey. Their habitats were rocky, which may have provided protection for them during and after the fire."

Coastal Environments

One unique feature of the fires that Glaspie points out is their close proximity to coastlines, which typically do not burn. However, due to the years-long drought, those soils have dried up, creating an even more unique situation now that the areas are ablaze.

“The soils in and around marshes have a lot of plant matter in them, and these fires are burning so hot and burning in such strange places that the soil itself is burning. So, you have areas where you have underground fires that are likely going to persist for probably a lot longer than fires in the trees, and they’re eating away a lot of that soil integrity and causing erosion and some in some cases, complete loss of topsoil,” she explained.

Glaspie described how the organic matter that is burning under the surface will start to smolder and produce a lot more smoke than, for instance, a tree forest burning would.

“There may be enhanced danger of smoke-related health issues in these coastal systems as they burn. In addition, with the scale on which this is happening, and the number of huge cities involved, I think there are certainly going to be health consequences of smoke inhalation, especially if the fires continue to burn for most of the year.”

Fisheries and Beaches

Much like Louisiana, Australia depends on its coastal habitats for fisheries, biodiversity, and protection from natural disasters. However, the same dried-up soils that are burning have another unique quality that can have long-term implications on the ecosystem.

Under the right circumstances, which just so happen to be when the soils are exposed to oxygen or being burned, they can produce sulfuric acid. With the soil being dried up for so long and now burning, Glaspie foresees a situation in the coming months where there will be an increase in acidification along the shorelines where a lot of fisheries, including crab, shrimp and a variety of fish, will see those impacts.

“I also should mention tourism,” noted Glaspie. “This spring, it is possible that areas that have been in the past okay, in terms of acid production, will now be problematic because once that kind of soil dries out, it’s really difficult to get it back to a state where it’s not just continuously producing acid. So, you could have areas where people traditionally use the beach to run for recreation that now are suddenly having problems with acidification.”

Grampians National Park. This area was burned during the 2013 Victoria Valley fire. This photo was taken two years later when Heru joined the Melbourne Museum’s research to re-survey small mammals in the region. Credit: Heru Handika.

Forest at Mt. Macedon, Victoria, Australia. This is after a prescribed burning. Credit: Heru Handika.

What will the recovery process look like?

While there’s no immediate end in sight for the fires, recovery is possible for the affected areas.

“It could take many, many years for a full recovery, and in some cases, you might just be looking at a system that’s completely different from what it was before. And, there may not be too much that can be done about that,” said Glaspie.

In other cases, it may just depend on what you mean by recovery.

“You know, an ecosystem might come back in the sense of yeah, it looks kind of like it did before the disturbance or it sort of functions like it did before the disturbance, but ah, that parrot or such and such marsupial is gone from it,” said Harms.

In the areas where the soil organic matter has not burned, the recovery process may not take as long because of what Harms explained as soil insulation.

“Soil is generally packed together, mixed of all sorts of things like organic materials and sand and clay and silt and rocks, so the soil is generally moist enough and has enough of that other stuff in it that the soil itself isn’t burning in most fires,” he explained.

Once the fires are controlled and the rainfall hopefully picks up, those surviving plants right below the earth’s surface protected by the soil will sprout up, possibly attracting more organisms to the area.

The animal population recovery will vary from species to species and on if there is another habitat suitable for recolonization. For the areas that have been severely burned, repopulation of species is possible, but it depends on how widespread the fire in the area was and how tolerant species are to the changed environment.

“Some species reproduce frequently and produce large litters and others might produce offspring every couple of years, so it’s really going to depend on the reproductive biology of the animal,” said Esselstyn.

While most of the recovery process requires nature to go about her business naturally, there are things we can do to help the process.

“One way might be to simply bring in organisms that were there before the fire and give them a leg up,” suggested Harms. “For example, there might be plants for which there’s a little bit of a soil seed bank, and maybe just by bringing in some seeds and with the rain coming back...we could spark (no pun intended) some germination.”

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