Bushfires damaged Australian rainforest that is home to Earth's only living specimens of ancient species

April 7 2020, by Kevin Sliman

In November 2019, fires burned to the edge of the Gondwana Rainforest in Nightcap National Park. Credit: Robert Kooyman

Recent wildfires in Australia torched more than 48,000 square miles of

land (for context, Pennsylvania is about 46,000 square miles). The fires impacted ecologically sensitive regions, including an area called the Gondwana Rainforests of Australia World Heritage Site. This region contains a vast concentration of living plants with fossil records from tens of millions of years ago, according to Peter Wilf.

In a letter in the March issue of *Science*, Wilf, an Institutes of Energy and the Environment co-funded faculty member, and two colleagues explain the importance of these regions and make an appeal to readers to conserve the land. Wilf's coauthors were Robert Kooyman, the letter's lead author and rainforest researcher at Macquarie University, Australia, and James Watson, professor of conservation science at University of Queensland, Australia.

"You may think of the Amazon when you think of rainforests, but Australia has just a few little pockets that are still wet year-round," Wilf said. "The areas are so small that climate change could just wipe them out in a geologic second and with it, wipe out more than 40 million years of rainforest history. The area of Nightcap National Park, about half of which was affected by the recent fires, is a World Heritage site because it is a living museum of paleo-Antarctic plants that are found nowhere else."

Wilf, a professor of geosciences in the College of Earth and Mineral Sciences, examines the time period of 70–45 million years ago, a period that he describes as a time of "immense global change." It includes the last great mass extinction (66 million years ago), which suddenly killed off the dinosaurs and 70% of living things. This time period also saw the recovery of the Earth's ecosystems followed by millions of years of global warming, starting around 60 million years ago.

"Many types of living things on the planet evolved very rapidly after the dinosaurs were gone," he said. "Then with the warming, there was more

evolution and a lot of movement of plants and animals across the Arctic and the Antarctic because the poles were so warm."

The movement of plants and animals in response to past climate change is one facet of Wilf's research. He has found many fossil plants that "aren't supposed to be there." For example, he and his team found fossils of the Asian chinquapin, part of the beech, oak and chestnut family, in southern Argentina. This discovery was notable because all previous fossils from this whole family had only been found in the northern hemisphere.

According to Wilf, the wildfires around the world are threatening to destroy some of the last ancient living-fossil forests on the earth and their living evolutionary history, like in the rainforests in Australia and Southeast Asia. It is these ancient forests that hold the connection to the history Wilf searches for.

"There is very little rainforest in Australia," Wilf said. "Those areas are home to plants that date back to when Australia, Antarctica and South America were part of the same land mass."

He and his colleagues have found abundant fossil evidence of diverse plants that survive in the Australian rainforest. Some of these fossils come from rocks that are 50 million years old or older and from as far away as Argentina.

Peter WIlf (left) and Robert Kooyman. Credit: Penn State

Wilf said that walking through those rainforests is about as close as you can get to walking in Antarctica 40 million years ago.

"The remarkable ancient plants include the Nightcap Oak," Wilf said. "Its origins lie in the paleo-Antarctic, going back maybe 90 million years. It is so rare that there are only about 125 adult plants remaining in the world, and they're all in one area."

During the recent Australia bushfires, about 10% of the Nightcap Oaks were destroyed.

Kooyman has been working with Wilf for years on these ancient forests and their fossil heritage. He said the letter was really a plea for recognition of the value of the Gondwana Rainforests and the need to protect them.

"The world must better understand natural ecological and evolutionary values and how to manage and safeguard them in a changing world," Kooyman said.

Wilf added, more broadly, that southeast Asia is ground zero for the biodiversity crisis, with higher extinction rates than any other region.

"And it is burning with devastating wildfires year after year, especially on the extremely biodiverse islands of Borneo and Sumatra," he said. "Southeast Asia is one of the most biodiverse regions in the world. It is just like the Amazon for tree diversity."

However, Wilf said that very little is known about the fossil history of this area, something he and his colleagues are addressing through field research in several countries.

Besides protecting ancient forests for scientific and educational purposes, Wilf said preserving fossil history can assist in conservation, and fossil values are used to directly support the establishment of reserves around the globe such as World Heritage Sites.

"By educating the public about what they are losing and explaining that a tree is not just a piece of wood—it's something that has a tremendous ancient history—we can see conservation efforts improve," he said.

More information: Jennifer Sills et al. Protect Australia's Gondwana Rainforests, *Science* (2020). DOI: 10.1126/science.abb2046

Provided by Pennsylvania State University