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Current Mass Extinction Spurs Major Study of Which Plants to Save

The Earth is in the midst of the sixth mass extinction of both plants and animals, with nearly 50 percent of all species disappearing, scientists say.

Because of the current crisis, biologists at UC Santa Barbara are working day and night to determine which species must be saved. Their international study of grassland ecosystems, with flowering plants, is published this week in the Proceedings of the National Academy of Sciences.

"The current extinction event is due to human activity, paving the planet, creating pollution, many of the things that we are doing today," said co-author Bradley J. Cardinale, assistant professor of ecology, evolution and marine biology (EEMB) at UC Santa Barbara. "The Earth might well lose half of its species in our lifetime. We want to know which ones deserve the highest priority for conservation."

He explained that the last mass extinction near the current level was 65 million years ago, called the Cretaceous Tertiary extinction event, and was probably the result of a meteor hitting the Earth. It is best known for the extinction of non-avian dinosaurs, but massive amounts of plant species became extinct at that time as well.

According to the current study, the most genetically unique species are the ones that have the greatest importance in an ecosystem. These are the ones that the

scientists recommend be listed as top priority for conservation.

"Given that we are losing species from ecosystems around the world, we need to know which species matter the most –– and which we should pour our resources into protecting," said first author Marc W. Cadotte, postdoctoral fellow at UCSB's National Center for Ecological Analysis and Synthesis (NCEAS).

Cadotte, Cardinale, and co-author Todd Oakley, an EEMB associate professor, put together a "meta-analysis" of approximately 40 important studies of grassland ecosystems around the world. They reconstructed the evolutionary history among 177 flowering plants used in these studies by comparing the genetic makeup of the plants.

The scientists found that some species are more critical than others in preserving the functions of ecosystems and that these species tend to be those that are genetically unique. Therefore, they are looking to evolutionary history for guidance in conservation efforts and in understanding the potential impacts of species loss.

Recent studies show that ecological systems with fewer species generally produce less biomass than those with more species. Less plant biomass means that less carbon dioxide is absorbed from the atmosphere and less oxygen is produced. So, as the biomass of plants plummets around the globe, the composition of gasses in the atmosphere that support life could be profoundly affected. Additionally, there are fewer plants for herbivorous animals to eat. Entire food chains can be disrupted, which can impact the production of crops and fisheries.

The loss of species that are not closely related to other species in the ecosystem reduces productivity more than the loss of species with close relatives. And the more genetically distinct a species is, the more impact it has on the amount of biomass in an ecosystem.

"Losing a very unique species may be worse than losing one with a close relative in the community," said Oakley. "The more evolutionary history that is represented in a plant community, the more productive it is."

Cadotte explained that the buttercup is a very unique species, evolutionarily. Losing the buttercup, where it occurs in grasslands, would have a much bigger impact on the system than losing a daisy or a sunflower, for example. The latter species are closely related. Each could therefore help fill the niche of the other, if one were to be

lost. The daisy and sunflower also have a more similar genetic make-up.

"These 40 studies are showing the same thing for all plants around the world," said Cardinale. "It is not a willy-nilly conclusion. This study is very robust. It includes studies of plants that are found throughout the U.S., Europe, and Asia. We can have a high degree of confidence in the results. And the results show that genetic diversity predicts whether or not species matter."

About UC Santa Barbara

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