**Original Article (DOI)**: 10.1038/s41559-019-0906-2

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**Word count (700-750 max):** 746

**Field:** Ecology & Evolution

**Twitter handle:** New overview of modern plant extinction by @AelysHumphreys, @vorontsovams and colleagues from @KewScience and @deepsthlmuni shows elevated rates of plant loss globally, especially in biodiverse regions such as oceanic islands.

Relevant twitter accounts: @AelysHumphreys, @vorontsovams, @deepsthlmuni, @KewScience

**Keywords**: -- Background extinction, conservation, islands, modern extinction, seed plants

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**Gone but not forgotten – plant extinction in modern times**

*Abstract:---* New review of plant extinction in modern times shows greatly elevated rates globally. Highest rates are for shrubs and trees and in biodiverse areas with many unique species, such as oceanic islands – areas particularly vulnerable to human activities.

*Suggested Picture*

We suggest the image of the Chilean sandalwood, *Santalum fernandezianum*, taken by Carl Skottsberg in 1908. The tree was popular for its aromatic sandalwood already by the 17th century. The image is of the last known living tree, which was cut down shortly after the picture was taken. The photo is more than 100 years old and should therefore be free from any copyright restrictions. Our second choice would be a colour photo of the St Helena olive, *Nesiota elliptica,* for which we have copyright.

The Chilean sandalwood can be seen here: <https://alchetron.com/Santalum-fernandezianum>

The St Helena olive can be seen here: <https://www.iucnredlist.org/species/37598/67372241>

What do you think of when you hear the word ‘extinction’? Chances are you think of dinosaurs or dodos. You’d be hard pressed to find someone who thinks of plants. This reflects that, until recently, we lacked a global overview of ongoing plant extinction.

Extinction occurs when the last living individual of a species or population dies. This is a natural process that has shaped life on Earth: it is estimated that the species alive today represent less than 1% of all species that ever lived. Biologists distinguish two types of extinction events: mass extinction and background extinction. Mass extinctions are ‘pulses’, high levels of extinction that occur relatively quickly (over tens of thousands to a couple of million years). In contrast, background extinction is the spontaneous replacement of one species with another in cycles of species formation and extinction. These replacement cycles typically last 1-10 million years (or longer). Mass extinctions are striking because of their profound biological consequences, eliminating entire groups of organisms and reshaping ecosystems, but they have not accounted for most species disappearance throughout evolutionary history. Up to 90% of all extinctions have occurred as background extinction.

The last major mass extinction occurred around 65 million years ago and famously led to the extinction of dinosaurs. Recent millennia have again witnessed elevated extinction rates, illustrated by the disappearance of almost all large birds and mammals in Australia, America and on isolated islands. Plant extinction also increased during this time, the best-known example being the *Rapa nui* palm that once dominated the forests of Easter Island. Scientists are still debating the causes of this increased extinction. The main suspects are altered climates, excessive hunting and harvesting, or both, but it’s clear that each extinction wave coincided with the arrival of modern humans in each area.

Most of what we know about past extinction is based on fossils. In recent centuries, naturalists have been collecting specimens of living animals and plants for formal description as species. These specimens, stored in herbaria and museums, provide a new source of information about extinction: species we know were alive when they were collected but are now presumed extinct. Evidence of these ‘modern extinctions’ is scarce, but most complete for birds and mammals. However, designing sustainable conservation programmes requires a more complete picture of ongoing extinction, one including plants, given their pivotal role in all ecosystems.

Enter Rafaël Govaerts at the Royal Botanic Gardens, Kew. He has been collecting published information on extinct seed plants for three decades. We recently reviewed this information to provide the first global overview of what plants are going extinct, where and how fast. We tallied almost 600 plant extinctions since Linnaeus pioneered scientific botany in the 18th century, a much higher figure than the previous listing of extinct plants and the number of extinct amphibians, birds and mammals combined. If all extinction during this time had occurred as normal background extinction, we would expect 4, or possibly as many as 20, extinctions to have occurred. In fact, we calculated that plants are disappearing *500 times faster* than the normal rate. However, we think these figures are low. This is partly because our knowledge of plant diversity is incomplete, meaning some extinctions go undetected, partly because some known extinctions remain unpublished and partly because many plants are already doomed to extinction by being ‘functionally extinct’ – alive but not producing new generations (flowering and setting seed).

We didn’t study *why* modern extinction rates are elevated. However, we found the highest rates for shrubs, trees, on islands and in areas with a tropical or Mediterranean climate –areas home to many unique species vulnerable to human activities. Therefore, current extinction is most likely driven by the same factors that threaten the survival of many living plants: loss of natural habitat due to deforestation and land use change.

If you only remember one aspect of our research, let it be that plant extinctions are happening, they are happening all over the world and they are happening fast. That may be easy to ignore if you are reading this in the middle of an urban area, seemingly disconnected from nature. But remember, plants provide the oxygen we breathe and the food we eat, as well as making up the backbone of the world’s ecosystems; plant extinction is bad news for all life, including us. Our study will improve predictions of future extinctions of plants, as well as other organisms, and aid development of conservation strategies to prevent them.