

# Plants: the known unknowns which are undermining conservation

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Taxonomy may be a 300-year old science, but it embraces new technology - and it works. Credit: Oxford Science Blog

We got the 'green' in green issues from the chlorophyll in plants. But the botanical world—which drives the planet's ecosystems—is the Cinderella science, struggling for resources and recognition, struggling even to keep up with the rate of extinction. And there's a reason for that—or quite a few, says Oxford Professor of Systematic Botany Robert Scotland.

While arbitrary international targets are set for 'saving [species](#)," loss is very much a reality in the funding-strapped world of [plants](#). The truth is, plants have been disappearing at the rate of at least two species a year, every year, for the last 250 years (but that's a very conservative estimate, we don't really know).

There are a lot of unknowns—and very big numbers—in the world of plants. Of the 370,000 known species of flowering plants on Earth, at least half are so poorly known they are almost invisible to any conservation effort—as fewer than 25% of flowering plants have a conservation assessment. In terms of insects, the situation is even worse: with just one million described species out of an estimated 6 million. To put these numbers in context, altogether there are some 36,000 birds, mammals and butterflies—about which much more is known.

We do know that about 40% of all land has been claimed for agriculture, so the assumption is that many plants and insects have already disappeared. But we do not really know. It is estimated because of this that more than half the plants in the world's collections are mislabelled. Imagine for a moment, how significant that (big number) is. If 50% of plants in collections have an incorrect name, what does that mean for our understanding of one of the biggest living groups on Earth? And what does it mean for conservation?

The fact is, plant taxonomy, the approach that could sort this situation, does not fit into the zeitgeist—science by innovation. There is innovation in plant science. Professor Scotland's team embraced all the technological advances available, including DNA and phylogenetic trees—earlier this year to create a door-stopping monograph of *Ipomoea* 'morning glories.' But the science, the pain-staking taxonomy of identifying and recording many known specimens in a species and creating a monograph, is unadulterated, hard-core botany. It may not be good TV, but it is fundamental and good science.

No Luddite, when walking his dogs, Professor Scotland enjoys using Google Lens to identify UK plants. "The app is often right in context of UK plants that are very well known," he says, surprised, although pleased to be able to catch it out. But the Professor stands by the science of monography, carefully cataloguing and classifying plants as the most effective way to bring order to the chaos of the botanical world—and make long-term progress.

It is essential, says Professor Scotland, to get to grips with what is there, before it is possible to save it. But at the moment, given a business-as-usual capacity, recent Oxford research has shown it takes about 100 years to discover a plant species, at the most basic level. From collecting the first specimen of a species, to describing it as new, and then gathering 15 correctly-identified specimens of that species, it can take a century.

According to a research paper from a team including Professor Scotland and Dr. Zoe Goodwin of Edinburgh, some 40 years is the initial discovery phase—that's from when the sample is brought in by a plant collector, to when it is identified by a botanist.

But, such is the lack of capacity in the system for taking this further, it can then be another 60 years before the next stage is completed and the 15 samples are gathered, as supporting evidence. It is a tortuous process. It impedes progress and action, but it is essential to identifying species.

What chance of achieving conservation targets, when there is no accurate inventory of plants? What chance can there be of a completed inventory of plants, when it takes 100 years even to reach a basic understanding of a species? How can this process be speeded up, when there is little interest or support for monographic taxonomy and no coordinated international policy—and half of collections are mislabelled? The task is simply enormous—and that is before we even

get to thinking about conservation and biodiversity.

Targets for [climate change](#) are clear and comprehensible. But when it comes to plants, the 2010 targets—for instance, to have conservation assessments for all plants by 2020—were 'pie in the sky,' according to Professor Scotland, "Well-meaning but out of reach."

He maintains, "The most recent high-profile policy suggestion is to simplify the message, as was done for climate change scientists, where the aim is to limit [global warming](#) to two degrees C. The suggested unified biodiversity target is to limit species' extinctions to 20 species per year for the next 50 years."

But a clearly exasperated Professor Scotland says, "This target is impossible to implement, given the lack of basic knowledge of the world's biodiversity

In fact, he says, most of the Convention on Biodiversity (CBD) international targets, from 2010-2020, 'were doomed to fail."

In simple terms, Professor Scotland explains, "There is no global strategy for sorting out the taxonomy of flowering plants and insects, so understanding the conservation status of many tropical plants and insects is simply not possible....unless you know what is there, how can you save it or monitor its health?"

Professor Scotland is not recommending an unreconstructed return to Victorian botany as a solution to the world's problems. But, he insists, it is essential to tackle the huge gaps in knowledge before significant global targets can be made.

### **Why does it matter?**

Clearly a cricket fan, he maintains, "Taxonomy is a front foot approach [attempting to tackle the issue, rather than taking a reactive approach]. But we are a very long way from any willingness [internationally] to see something worthwhile in this, despite the evidence."

Much can be learned from the experience of creating the *Ipomoea* monograph. Although they were following the path of the first monographer, another Scottish-born Oxford botanist, the celebrated Robert Morison, Professor Scotland and the team confronted the very modern reality of the international plants problem. It was clearly a seminal experience.

It is tempting for the team to reflect that not much has changed in the 300+ years since Morison created the world's first monograph [of the carrot family]. But taxonomy is in some ways more difficult now than in the past, because of the huge number of specimens that now exist, a voluminous messy literature and many names associated with a group (60-70% of published plant names are usually synonyms). Years of effort was needed to identify the many specimens of *Ipomoea* in collections around the world—many were synonyms, as the same species had been 'discovered' and named multiple times.

Professor Scotland maintains, "On the one hand there is a huge diversity of plants, which is a great resource for humankind. But it needs sorting out.

"On the other hand, if you're attempting to monitor the health of biodiversity and extinction accurately, you need to know what's there. We're never going to get to a comprehensive system where we know everything, but we are a very long way from knowing even half of the world's biodiversity in any detail."

**More information:** Zoë A. Goodwin et al. How long does it take to

discover a species?, *Systematics and Biodiversity* (2020). [DOI: 10.1080/14772000.2020.1751339](https://doi.org/10.1080/14772000.2020.1751339)

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