CHRIS MADDALONI/*NATURE*

Curator Vicki Funk of the US National Herbarium displays one of the collection's 5 million specimens.

BOTANY

Plant collections get pruned back

North America's herbaria wilt under budget pressure.

BY BOER DENG

Herbaria in North America are withering away. Collections of preserved plant specimens that have been accumulating for a century or more are being closed and consolidated as tight budgets and competition for space put pressure on universities to direct resources to facilities such as labs.

More than 100 North American herbaria have closed since 1997, leaving just over 600 remaining. The latest casualty came in May, when the University of Missouri in Columbia announced that it will close its Dunn-Palmer Herbarium, a 119-year-old collection of more than 170,000 plants and thousands of mosses, algae and fungi.

There is a perception that herbaria are dead places, says plant biologist Kathleen Pryer, who manages the herbarium at Duke University in Durham, North Carolina. But far from being relics, botanists argue, these repositories of preserved specimens are relevant to today's research.

For instance, DNA from specimen plants helps botanists to improve the accuracy of phylogenetic trees, and surveys of when and where specimens were collected can show the effects of climate change on species range. Ecologists and conservationists will always need to be able to distinguish thorn from thistle in the field, says biologist Roxanne Keller of the University of Nebraska Omaha. Digital archives are useful, she says, but only with the real thing can you feel the points of a bristle or trace a tendril's curl. "You can't get those details from a picture."

That sensory experience may be less valued these days because many botanists now find themselves small players in broader biological-sciences departments. Few outside their field appreciate the merits of having specimens on hand. Department heads and deans are always "mystified" about herbaria, Pryer says.

Herbaria can feel more antique than avant garde. The US National Herbarium in Washington DC houses a preserved cutting from the first Concord grape, a commercially important US breed first cultivated in 1849. The label identifying a sunflower from South America, brown with age, is written in the spidery Cyrillic scrawl of a nineteenth-century Russian collector.

That fusty feel belies the present-day questions that the specimens are being tapped to tackle. Isotopic analyses of specimens of the rainforest species *Humiria balsamifera* that date as far back as 1788, for example, show that as atmospheric carbon dioxide levels increased with industrialization, the plants responded by increasing photosynthetic activity and using water more efficiently (D. Bonal *et al. Plant Cell Environ.* **34,** 1332–1344; 2011). The findings are important to climate modellers and others who want to predict how ecosystems will respond as CO_2 levels rise in coming decades.

Researchers have also used specimens collected during the first few decades of the twentieth century to track the spread of cheat grass (*Bromus tectorum*), an invasive species from Europe, throughout the US southwest. The pattern supports a growing body of evidence that successful invasions require multiple introductions of an exotic species (A. R. Pawlak *et al. Biol. Invasion.* **17,** 287–306; 2015).

Herbaria do not necessarily disappear altogether when they close. Their specimens are often absorbed by other institutions: the Rancho Santa Ana Botanic Garden in Claremont, California, for example, has taken in at least three other collections since 2000. In one case, staff had to race against an impending rainstorm to rescue specimens from a loading dock where they had been unceremoniously dumped. "We more or less had to drop everything and go and fetch it," recalls Lucinda McDade, the garden's executive director.

Drama also surrounded the 2004 transfer of the herbarium at the University of Iowa in Iowa City to Iowa State University in Ames. A lawsuit tried to stop the move, but eventually more than 200,000 specimens were packed up and driven the 200 kilometers to Iowa State. And last year, the Brooklyn Botanic Garden in New York said that it would sell the building that housed its herbarium. In April, the garden lent its collection to the New York Botanical Garden until room can be found for it elsewhere. But some curators worry that the move out of Brooklyn will prove permanent.

Merging collections can have benefits, says James Miller, vice-president of science and conservation at the Missouri Botanical Garden in St Louis, which will absorb the Dunn-Palmer collection. Samples can be better curated at larger institutions, and might catch more researchers' attention. But taking in an orphaned collection is a mixed blessing. It can take years to catalogue the new samples, making it difficult to access them for study. And institutions must also find a way to do that work at a time of dwindling funds and staff cuts. "I'm glad we're getting new specimens," says Miller. "But a part of me is always sad when another herbarium closes."

Compared with other biological sciences, botanists feel that they have long struggled for respect. In 1988, 72% of the 50 top-funded US universities offered advanced degrees in botany. More than half of those programmes have been jettisoned, even though the need for soil and plant scientists is expected to rise modestly over the next decade, according to the US Bureau of Labor Statistics. "Getting people interested in living plants is a challenge," says Pryer. Convincing them of the importance of keeping flattened, wizened sprigs is even tougher.

But it is important to do so, botanists say. "A lot of us got started studying plants by wandering into the college herbarium by accident," says Vicki Funk, a botanist and curator at the US National Herbarium. "What happens if they all get carted off?" ■