Seed time-capsule will aid study of plant evolution amid environmental change

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Everything that scientists can ever know about long-gone creatures is what they can deduce from fossils. But what if they could resurrect actual specimens and compare their features with their modern-day descendants? That's a notion that has University of Toronto biologists helping to create a seed bank that will let future researchers do exactly that with plants, allowing them to measure evolution caused by global change.

"Today's plants are the ancestors of future generations," says Arthur Weis, a U of T ecology and evolutionary biologist and director of the Koffler Scientific Reserve. "Decades from now, plant biologists can go to the same populations as we are collecting from now and collect seeds from 'descendant' generations. By growing the ancestor seeds and descendant seeds under the same conditions, they will be able to detect which traits have changed and which have not."

Project Baseline - an undertaking of a group of plant evolutionary biologists that includes Weis – was awarded US$ 1.2 million from the National Science Foundation, to spend the next four years collecting seeds that will be banked for anywhere from five to 50 years. Researchers will then be able to draw on them to analyze how a species reacts to changes in their surroundings such as climate change, species invasions, and new land-use patterns.

The researchers have identified 34 target species that are common, easy to grow and well-studied by ecologists and evolutionary biologists, as

well as some close relatives of those species. "We've chosen ones with a variety of traits, such as different flowering times or pollination strategies, as well as diverse roles in their ecosystems," says Weis. "The goal is to gather seeds from thousands of plants across 20 broadly distributed locations, such as national parks, reserves, and long-term research sites – places where the plants will likely still be 50 years from now."

The Koffler Scientific Reserve will be the anchor location for the Canadian effort. It will also collect seeds of several additional species of local concern, including Black-eyed Susan, Queen Ann's lace and Trillium plants.

Weis and several colleagues proposed the idea in 2008, after realizing that plant evolution occurs on time scales biologists could measure if they had the right materials. In 2005, Weis conducted an experiment which showed that a five-year drought in California had caused change in the flowering time of the mustard plant Brassica rapa, using pre-drought seeds stored in the researchers' lab freezer. Having those seeds was merely fortuitous, though it provided the germination of the idea to set up a seed bank expressly for future evolutionary studies.

The project is unique among other existing programs that only collect seeds of species threatened by extinction. "Other projects are Noah's Ark-type of projects that serve a conservation purpose," says Weis. "Our project seeks species that are in abundance and will be around in 50 years, not to preserve them but to better understand the nuts and bolts details of evolutionary change."

Provided by University of Toronto