

# 20 22

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## ANNUAL REPORT

Northern tallgrass prairie  
NatureServe Global Status: Imperiled (G2)

*Photo by Brett Whaley*



# Message from Leadership

At NatureServe, we have reimagined the annual report. As always, we have included information to show our supporters that we are good stewards of donations, grants, contracts, and of the most authoritative data on biodiversity. However, we also want our annual report to serve as an educational tool that expands readers' knowledge about the state of biodiversity in North America.

Before you read the rest of this letter, I encourage you to peruse the [beautiful ecosystem map on our website](#). This is the first time the ecosystems of all the United States and Canada have been mapped together. Then, read the report to learn how human activity affects ecosystem services and how NatureServe provides critical information to help protect the most imperiled species and ecosystems across our continent; after that, return to this letter!

Four years ago, we shared information about imperiled animals; three years ago, plants; two years ago, we highlighted invertebrates; and last year, we presented terrifying levels of species at risk of extinction in each state, province, and territory across North America. Last year's annual report provided a glimpse of the information featured in the recently published [Biodiversity in Focus](#) report that made national and international headlines for its alarming finding: over one-third of plants, animals, and ecosystems (34 percent, 40

percent, and 41 percent, respectively) are imperiled in the United States.

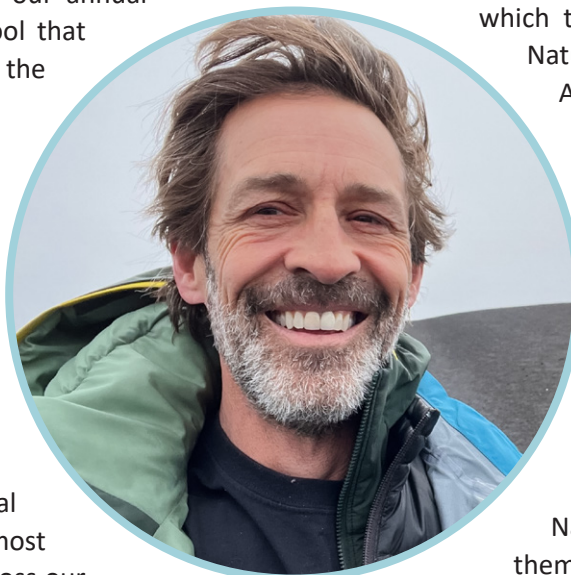
This focus on the full range of biodiversity—rather than on individual species—and the ecosystems on which those species depend is what makes NatureServe unique. Throughout North America, NatureServe stands alone in our ability to tell the story of what comprises a given ecosystem, where it exists, and how we can best promote its conservation given current threats.

This year's annual report is a conservation tool that has been made possible thanks to the help of the amazing professionals and scientists at NatureServe and in the NatureServe Network. I want to thank them for their tireless work ensuring that biodiversity thrives for future generations of humans and for all species. I also want to thank you, our supporters, for all you do to help us protect our shared natural world.

Onward and upward,



**Sean O'Brien, Ph.D.**  
President & CEO



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## About the Cover

For the cover of this year's annual report, we selected a photo of the northern tallgrass prairie, an iconic habitat among North American ecosystems. Unfortunately, many grasslands in the midwestern United States and southern Canada are highly threatened today. According to the NatureServe report *Biodiversity in Focus: United States Edition*, 51 percent of the 78 grassland ecosystem types in the United States are at risk of range-wide collapse. Learn more about the status of U.S. ecosystems and species at [www.natureserve.org/bif](http://www.natureserve.org/bif).

# Victories from 2022

We are proud to share some of the positive outcomes of recent work by NatureServe and the NatureServe Network. Through close collaboration with our partners across industries, these achievements in 2022 helped support our mission.

There are nearly 1,000 scientists who work with natural heritage programs and conservation data centers across the United States and Canada to protect imperiled biodiversity. In 2022, NatureServe CEO and President Sean O'Brien visited 16 programs across 12 western states and 4 western Canadian provinces. To date, [Sean has visited 35 NatureServe Network programs.](#)



Joe Rocchio (Washington Natural Heritage Program) examining rare peatmoss at Crowberry Bog Natural Area Preserve in Washington

Published by NatureServe in collaboration with Esri, the Nature Conservancy, and the NatureServe Network, the [Map of Biodiversity Importance](#) showed that nearly 300 imperiled species rely on habitat completely outside of protected areas. Additionally, almost every one of the lower 48 states has specific areas with opportunities to take action and prevent extinctions.



Jamaican rock iguana (*Cyclura collei*)  
IUCN Red List Status: Critically Endangered (EN)  
Photo by Joey Markx

After 15 years of research, the [Global Reptile Assessment](#) was published in the journal *Nature*. Authored by scientists from NatureServe, the International Union for Conservation of Nature (IUCN), and Conservation International—with contributions from more than 900 researchers—the study found that 21 percent of reptiles worldwide are threatened with extinction. The paper's results were featured across mainstream national and international media outlets.



The Map of Biodiversity Importance

The IUCN Red List of Ecosystems is the global standard for assessing the risk status of ecosystems. NatureServe is an important partner in informing the Red List for North American ecosystems. Using the Red List criteria, NatureServe found that [over 200 of the 665 terrestrial ecosystem types in North America are Critically Endangered, Endangered, or Vulnerable.](#)



Mesic longleaf pine flatwoods – spodosol woodland  
NatureServe Global Status: Imperiled (G2)  
Photo by Michael Lee, NatureServe

A new assessment of U.S. trees revealed that up to [16 percent of tree species in the contiguous United States are threatened with extinction.](#) The study was conducted by Botanic Gardens Conservation International (U.S.), the Morton Arboretum, and NatureServe in partnership with the United States Botanic Garden and the U.S. Department of Agriculture Forest Service.



Yellow-banded bumble bee (*Bombus terricola*)  
NatureServe Global Status: Vulnerable (G3)  
Photo by Thomas Wood

Nearly 1,000 pollinator species, including bees and flower flies, were assessed and ranked for their risk of extinction by a team of NatureServe Network scientists from several northeastern states. These conservation status ranks, publicly available through [NatureServe Explorer](#), help guide the conservation of vital pollinator species.



Bur oak (*Quercus macrocarpa*)  
NatureServe Global Status: Secure (G5)  
Photo by Morton Arboretum



# Effects of Climate Change on Ecosystems

Climate is a key element driving the distribution and survival of species and ecosystems. As global temperatures increase and patterns of precipitation change, natural ecosystems are put under stress. For example, more intense and frequent extreme weather events, such as hurricanes or droughts, may cause species to relocate or perish due to the elimination of resources such as food or shelter. The negative effects of climate change on ecosystem health are exacerbated by other human-caused factors, such as habitat destruction, habitat fragmentation, and the introduction of invasive species.

NatureServe and the NatureServe Network collect data on ecosystems across time and space to understand how different ecosystems respond to climate change. For instance, we have studied the effects of sea level rise on wetlands, the effects of temperature rise on high-elevation meadows, and the effects of increased wildfires on a variety of habitats. Scientists use this information to help land managers make science-based decisions that prioritize biodiversity conservation in a changing world.

To determine how vulnerable a given natural community might be to climate change, NatureServe developed the [Habitat Climate Change Vulnerability Index \(HCCVI\)](#). The HCCVI integrates elements that influence vulnerability such as climate change exposure, which encompasses the nature and magnitude of changes in temperature and precipitation, and climate change resilience, which is the ability of a habitat to maintain species and ecological processes as climate changes. Resilience measures an ecosystem's natural adaptive capacity and its sensitivity to climate change, including the impact of non-climate stressors such as human-caused environmental degradation. The HCCVI provides a measure of overall vulnerability to climate change and identifies specific areas where an ecosystem is either more or less vulnerable to change.



## Case Study: Managing Climate Change in Pinyon-Juniper Ecosystems

In one example of how NatureServe and the NatureServe Network used the HCCVI, scientists assessed ten different pinyon-juniper ecosystems (per the U.S. National Vegetation Classification) found in the western United States. These ecosystems, dominated by pinyon pine trees (*Pinus* spp.) and juniper trees (*Juniperus* spp.), provide habitat for wildlife, including at-risk species such as the Vulnerable (G3) pinyon jay (*Gymnorhinus cyanocephalus*). Pinyon-juniper ecosystems are unfortunately experiencing widespread die-offs due to a rise in temperatures combined with long-term drought associated with climate change. These conditions have exacerbated other threats to pinyon-juniper ecosystems, such as invasive bark beetles and more frequent forest fires.

NatureServe scientists used the HCCVI to map climate exposure and ecosystem resilience across all ten pinyon-juniper ecosystem types. Variations in environmental conditions such as topography, fire regimes, and habitat fragmentation influence the vulnerability of the different ecosystem types. We identified each region's vulnerability to climate change and provided climate adaptation recommendations. In the HCCVI framework, managers are encouraged to consider choosing between Resistance, Resilience, and Transformation management schemes, depending on the level of vulnerability to climate change.



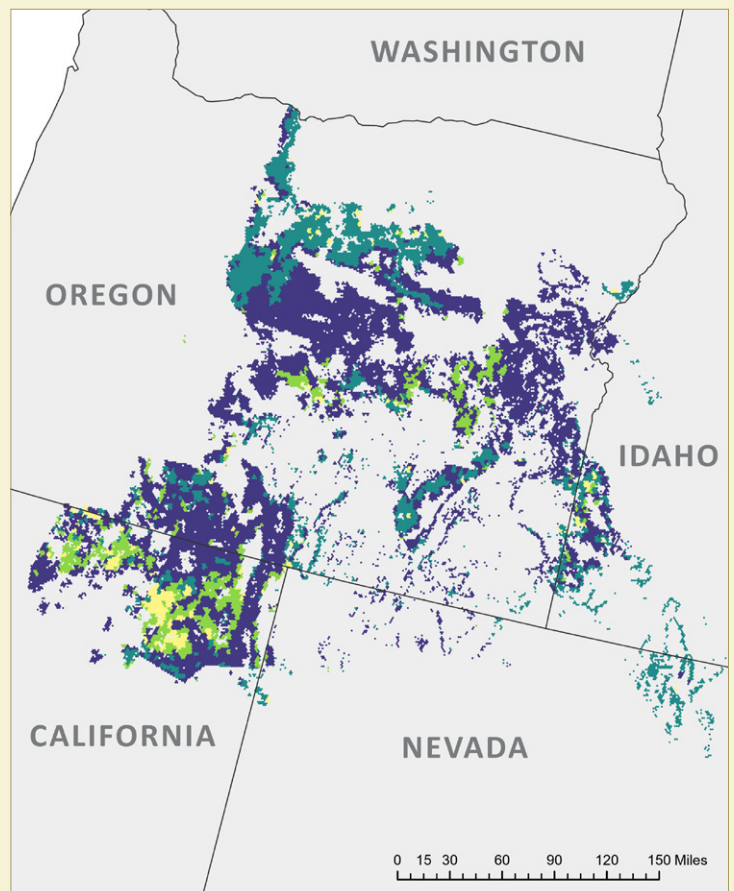


Colorado Plateau pinyon - juniper woodland  
 NatureServe Global Status: Apparently Secure (G4)  
 Photo by Deborah Lee Soltész, U.S. Forest Service

Where vulnerability is high, managers are encouraged to consider transformation to an alternative natural ecosystem type that is more suited to the new climate. In locations where climate vulnerability is low, resistance to climate change effects may still be feasible. Our management recommendations for these pinyon-juniper ecosystems were therefore tailored to the different situations across their range, providing targeted guidance in response to climate change.

	Adaptation Zone	Recommended Action Example*
More active management ↑ ↓ Less active management	<b>Directed Transformation</b>	Promote a natural community adapted to new conditions through hands-on, active management (e.g. planting native grasses rather than trees where fire and climate are favoring grassland conditions)
	<b>Autonomous Transformation</b>	Apply restoration techniques designed to increase native species diversity
	<b>Resilience</b>	Restore native vegetation to enhance the ability of species to persist as the climate changes by removing barriers to movement and dispersal
	<b>Passive Resistance</b>	Maintain current ecosystems by expanding protected areas that are buffered from climate impacts

\*Recommendations followed the adaptation framework by [Peterson St-Laurent, et al., Communications Biology 4, no. 1 \(2021\): 39.](#)



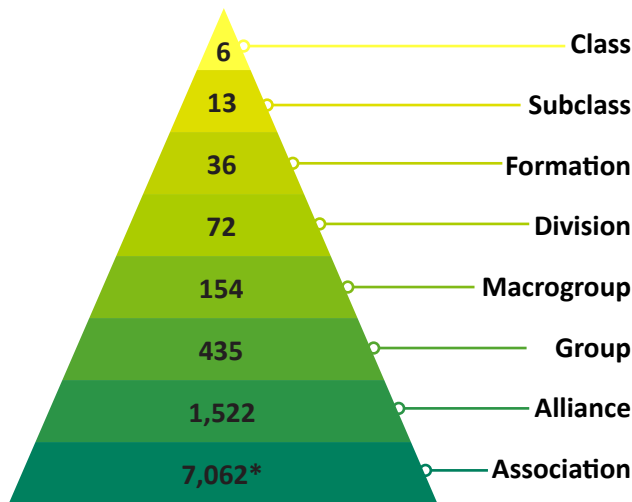
A map of climate-smart adaptation zones based on HCCVI rankings in the Columbia Plateau Western Juniper Woodland and Savanna ecosystem



# Dive into the Data

Just like with species, the description and classification of ecosystems provide standard units that we can map, analyze, and discuss.

The chart below shows the number of terrestrial ecosystem types in the United States and Canada at each level of the International Vegetation Classification hierarchy.



Ecosystem Types per Level

\*Association counts are incomplete for several U.S. states (especially Alaska and California) and various Canadian jurisdictions.



## Ecosystems

Ecosystems, like species, are classified at different levels of granularity, from broad categories, such as tropical forests and warm deserts, to local-scale communities.



## Species

Level	Name
Class	Forest and Woodland
Subclass	Temperate and Boreal Forest and Woodland
Formation	Cool Temperate Forest and Woodland
Division	Vancouverian Forest and Woodland
Macrogroup	Vancouverian Coastal Rainforest
Group	Californian Coastal Redwood Forest
Alliance	Coastal Redwood Forest
Association	Douglas-fir - Redwood/Western Swordfern Forest

Californian coastal redwood forest  
NatureServe Global Status: Vulnerable (G3)  
Photo by Sundry Photography

Taxon	Name
Kingdom	Plantae
Phylum	Coniferophyta
Class	Pinopsida
Order	Pinales
Family	Supressaceae
Genus	<i>Sequoia</i>
Species	<i>sempervirens</i>

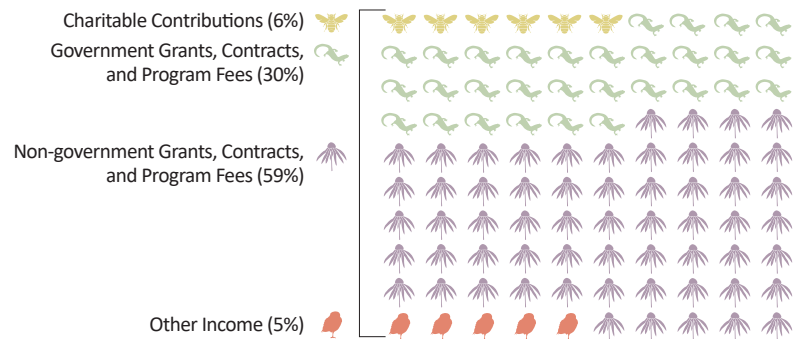
Redwood (*Sequoia sempervirens*)  
NatureServe Global Status: Apparently Secure (G4)  
Photo by Sundry Photography

# Financials

July 1, 2021–June 30, 2022

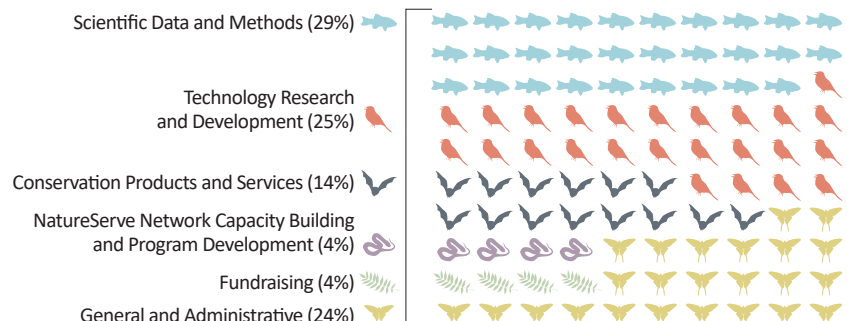
## Revenue

Charitable Contributions*	6%	\$538,407	
Grants, Contracts, and Program Fees			
Government (Federal, State, and Local)	30%	\$2,726,917	
Non-government	59%	\$5,403,950	
Other Income**	5%	\$422,432	
<b>Total Operating Revenue</b>		<b>\$9,091,706</b>	
Investment Gains		-\$584,154	
<b>Total Revenue</b>		<b>\$8,507,552</b>	



## Expenses

Program Activities			
Scientific Data and Methods	29%	\$3,304,644	
Technology Research and Development	25%	\$2,793,742	
Conservation Products and Services	14%	\$1,616,294	
NatureServe Network Capacity Building and Program Development	4%	\$413,517	
Fundraising	4%	\$421,873	
General and Administrative	24%	\$2,716,097	
<b>Total Expenses</b>		<b>\$11,266,166</b>	



Net assets as of June 30, 2022: \$3,629,222

\*Charitable contributions include those from individual donors and corporate sponsors, as well as grants from foundations.

\*\*Other income includes membership dues, rental income, investment income, registrations, and royalties.

NatureServe's financial statements for the year ending on June 30, 2022 were audited by the certified public accounting firm of GRF CPAs & Advisors.

# Around the NatureServe Network

In addition to the accomplishments highlighted below, representatives from NatureServe Network programs gathered at the first in-person Biodiversity Without Boundaries Conference since 2017! Stay tuned for details about the 2024 conference.



A trained summit steward with the Adirondack Mountain Club, Liam Ebner, rediscovered purple crowberry (*Empetrum eamesii* ssp. *atropurpureum*) on Mount Mansfield. This small, high-elevation shrub had not been seen in Vermont in over a century. “This is an extraordinary find,” said Bob Popp, a botanist with the Vermont Natural Heritage Inventory. This subspecies is globally Secure (T5) but was Presumed Extirpated (SX) in the state of Vermont.

Botanists at the Pennsylvania Natural Heritage Program and the New York Botanical Garden described a new plant species in the southeastern United States: the stiletto beaksedge (*Rhynchospora stiletto*). This species is Imperiled (G2) and known to occur only in Alabama, Arkansas, Missouri, and Tennessee. The cooperation of scientists across several states contributed to the understanding of this new species.



The Yukon Conservation Data Centre led a Bioblitz at Beaver Creek. This week-long event found more than 1,700 species representing one-fifth of all Yukon’s flora, fauna, and fungi. Over 80 of those species had never been found before in the territory.

The Virginia Natural Heritage Program used species habitat modeling to identify promising locations for restoring biologically diverse longleaf pine communities in the state. This is part of a larger effort in partnership with the Florida Natural Areas Inventory and the Longleaf Alliance to support the restoration of longleaf pines within this global hotspot.



Natural Heritage New Mexico teamed up with five state agencies to launch the Environmental Resource Database of New Mexico web application. This new tool, built with NatureServe’s Environmental Review Tool framework, combines key environmental datasets into a centralized, map-based application to help guide decisions about environmental issues.

The Arkansas Natural Heritage Commission (ANHC) acquired its 78th and 79th natural areas: the 1,191-acre Sugarloaf Mountains-Midland Peak Natural Area and the 540-acre Goat’s Beard Bluff Natural Area. Both areas contain important ecosystems that are home to imperiled species that were identified by the ANHC.



For several years, Wyoming’s only federally listed invertebrate animal—the Critically Imperiled (G1) glacier forestfly (*Zapada glacier*)—was thought to occur in only one place in Wyoming, as well as two places in Montana. Thanks to survey efforts and genetic analysis, Wyoming Natural Diversity Database scientists found several new populations of the species in mountain ranges across Wyoming.

The North Carolina Natural Heritage Program and the North Carolina Department of Public Safety (DPS) partnered to dedicate a portion of correctional facility lands as a nature preserve. They are hopeful that this new partnership will result in more dedicated nature preserves on the 36,000 acres managed by DPS.



# Our Supporters

NatureServe is supported by a community of institutions and people passionate about protecting biodiversity and preventing extinction. Each contribution strengthens our ability to serve as the authoritative source for biodiversity data in the United States and Canada.

## TRUSTED NONPROFIT

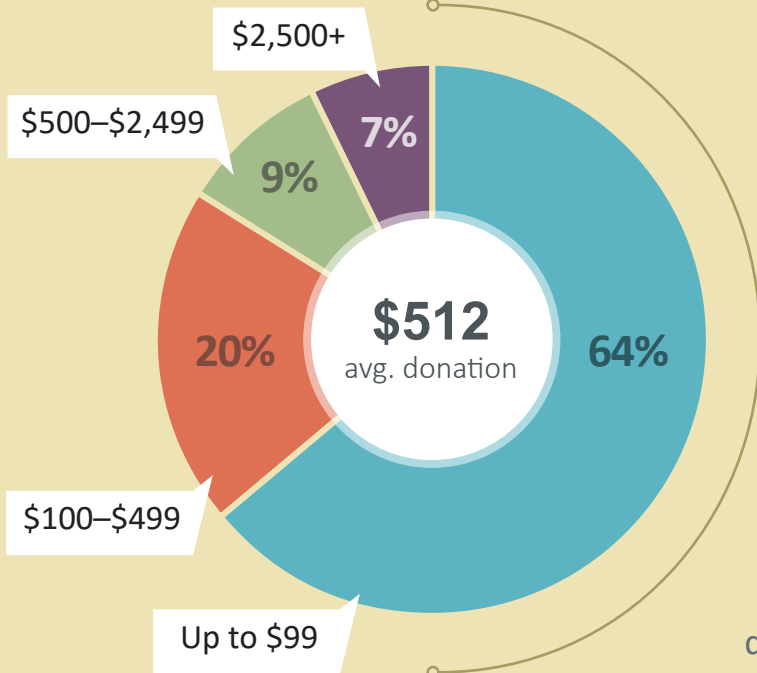


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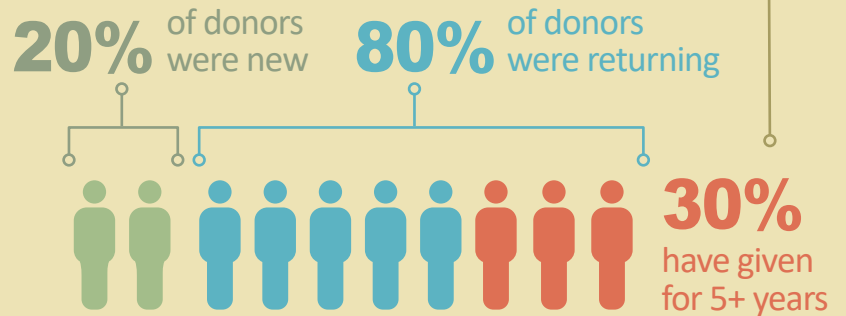


Open the camera on your phone and hold it over the QR code to scan.

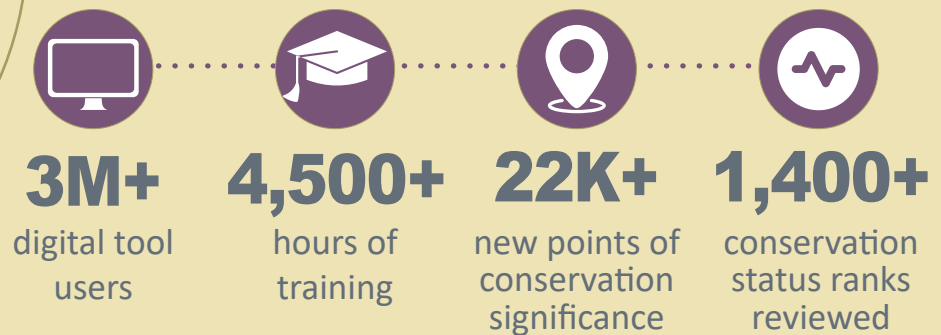
## DONATIONS BY DOLLAR AMOUNT



## DONORS BY TENURE



## IMPACT SNAPSHOT



## Thank you

These institutions and individuals made charitable contributions to NatureServe between July 1, 2021, and June 30, 2022. A complete list of supporters and business partners can be found on our website: [www.NatureServe.org/our-thanks](http://www.NatureServe.org/our-thanks)

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