

WORK TOGETHER: CITIZEN SCIENTISTS AND THE NATURESERVE NETWORK

Citizen science taps the human passion for exploration and discovery to illuminate our understanding of the natural world. Functioning as both a scientific methodology and an organizing principle, citizen science encourages amateur participants (who, in the word’s original sense, do the work for love, not money) to take an active part in creating knowledge by aligning their interests and labor with those of professional scientists.

Public participation in scientific research for the common good is not new: its history is deeply rooted in ideals of the Enlightenment and American populism, as natural expressions of intellectual liberty and local, civic identity. Citizen science provides significant societal benefits by increasing scientific knowledge and capacity, promoting scientific literacy, and encouraging broad public engagement in decision-making about natural resource use and management. Thanks to advances in handheld computing, online mapping, and web technologies, nearly anyone on Earth can collect valuable data on species, their habitats, and the rapid changes impacting them both—though, to be sure, birders, naturalists, gardeners, hunters, fishers, trappers, ranchers, students, teachers, and other outdoor enthusiasts are the most likely contributors.

The NatureServe network has four decades of experience developing scientific knowledge to guide conservation of rare and imperiled species and all types of ecosystems worldwide. NatureServe uniquely possesses a combination of existing data, expertise, application tools, and network of partnerships to maximally leverage the opportunity offered by citizen science. Although many network members participate in citizen-science projects (briefly detailed in *Appendix 1*), NatureServe has not had a formal approach for incorporating data from such efforts into our methods. As a result, we have neither developed specific data standards and tools nor implemented the business processes needed to incorporate citizen science data with our international datasets and maps



Photos in this document highlight activities during a Goldman Sachs Community Team Works project co-hosted by the New York Natural Heritage Program (<http://www.nynhp.org>) and NatureServe at Breezy Point, Long Island, in August 2011.

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of at-risk species occurrences, invasive species, and ecosystems.

In calling for better communication of trends in the distribution and condition of species and ecosystems across the Americas, our 2012-2016 Strategic Plan recommends broader network engagement with citizen scientists to facilitate more rapid and comprehensive recording of field observations. The overall rate of change to the elements of biodiversity is outpacing professional capacity for monitoring (Milne et al. 2006). Threats to biodiversity are increasing in scope and pace, requiring both more frequent and greater amounts of data to understand how species and ecosystems are changing over time. Large volumes of up-to-date data are critical to any “early warning system” capable of alerting us to declining populations or habitats.

At the same time, public policy and budget battles across all levels of government continue to limit network members’ capacity to obtain data through staff-led field surveys alone. We believe a coordinated strategy of collaborating with citizen scientists will provide an important, cost-effective means for rapidly increasing the number of observations needed to document patterns of biodiversity and habitats in a rapidly changing world, including potential declines or conservation successes (Kelling et al. 2009, Magurran et al. 2010, Schmeller et al. 2008).

NATURESERVE’S VISION FOR CITIZEN SCIENCE ENGAGEMENT

NatureServe will strive to provide citizen scientists with tools that collect and manage data in ways that improve its quality, interoperability, and applicability — thereby enhancing the enjoyment they gain from their experiences in the natural world. NatureServe will partner with and build upon select existing citizen science tools and programs, emphasizing collaboration with efforts that are consistent with our data standards and organizational mission. By connecting citizen science data to larger international datasets, broader scientific networks, and demonstrations of its useful application, we can help ensure that citizens’ activities will contribute directly to effective conservation action.

At the same time, collaborating with citizen scientists will expand the reach, effectiveness, and impact of the NatureServe network and its biodiversity scientists, information specialists, and other professionals in their efforts to guide conservation action.



MUTUAL BENEFITS OF COLLABORATION

The widespread use and application of citizen-collected data in species and habitat trend analyses faces some obstacles (Dickinson 2010) that NatureServe is well qualified to help address. The first arises from a need to demonstrate that such data are of **sufficient quality** to be used as the basis for decision-making. The second stems from the concerns about aggregating **large volumes of data from multiple sources** that employ different standards. In addition, save for a few notable exceptions like the Cornell Lab of Ornithology and National Audubon Society's eBird, citizen-science projects often do not incorporate information on **survey effort** and **absence data**, which can impede the ability to detect trends (see *Box 2*).

NatureServe's experience can address each of these scientific concerns. Our network's methods and systems rely on a foundation of clearly documented, rigorous standards that support both data quality and the aggregation of detailed observation data. The distributed nature of the network supports data at multiple spatial scales while handling sensitive location data for at-risk species. We routinely utilize field observations as a foundation for sophisticated spatial models, sustaining this work through a decades-long commitment to improving the scientific knowledge needed for effective conservation action.

Benefits to Citizen Scientists

Volunteers who participate in citizen science projects do so for many reasons—such as personal enjoyment and education, hands-on involvement in exploration and discovery, concerns about anthropogenic threats to the environment, or feelings of responsibility or stewardship for the natural world. By expanding its collaborations with those who organize citizen science projects, the NatureServe network can deepen and enrich these intangible benefits by helping citizens:

- Learn more about the patterns and distribution of species and habitats across geographic scales
- Interact and engage with professional scientists
- Acquire first-hand knowledge of processes and



tools that support large-scale investigation and understanding of the elements of biodiversity

- Earn personal and professional validation of their interest, expertise, and efforts
- Gain access to and provide input on newly developed tools, apps, and data
- See their data put into wider use and application in research and policy settings

Benefits to NatureServe

By increasing the network's engagement with citizen science initiatives, the member organizations and staff of the NatureServe network can advance their shared mission to provide the science needed for effective conservation by helping to:

- Increase the number of observations for at-risk species, leading in turn to:
 - More accurate assessments of conservation status
 - Improved sets of conservation priorities
 - More effective on-the-ground conservation
- Increase the capacity of the network members to conduct field surveys
- Forge new, professionally rewarding partnerships that also increase awareness of the value of the network and its members
- Increase opportunities to fund inventory and monitoring activities



NATURESERVE'S CITIZEN SCIENCE STRATEGY

To continue providing the scientific basis for effective conservation action, NatureServe will engage with citizen scientists to expand ongoing efforts to monitor trends in the distribution, condition, and threats associated with biodiversity. We envision four strategic results (as shown in *Figure 1*):

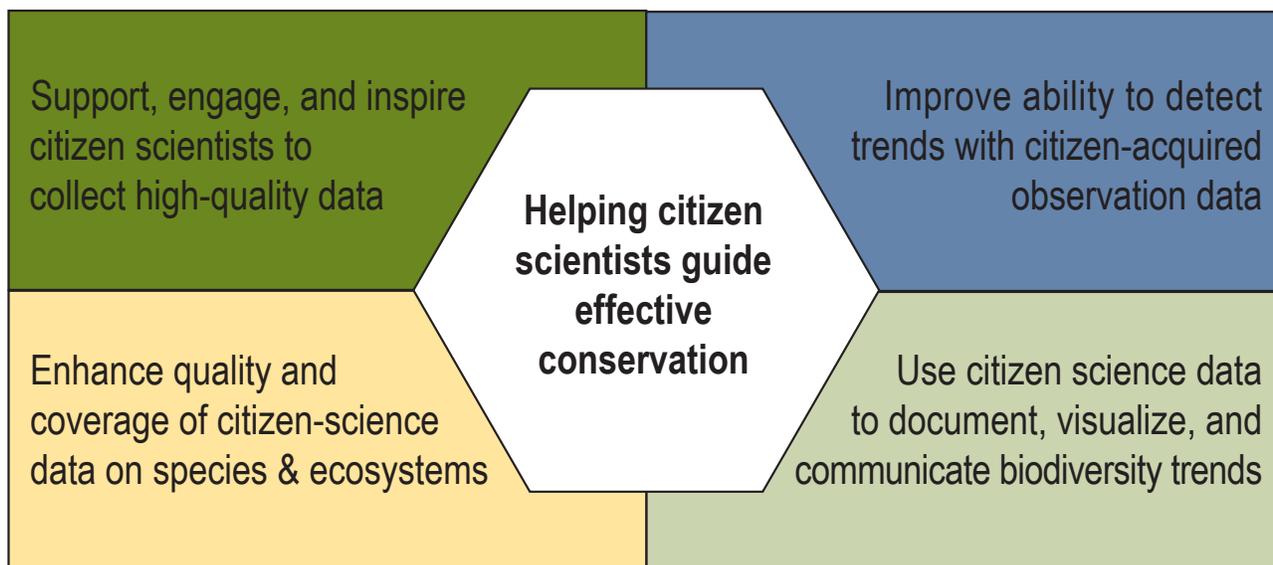


Figure 1. NatureServe proposes to pursue four strategic results that will increase the use of citizen science observations in guiding effective conservation action.

- 1** The NatureServe network expands its capacity through a range of partnerships to **support, engage, and inspire citizen scientists** to collect high-quality and high-priority data.
- 2** Citizen observations will **improve trend detection** in the status of species and ecosystems through enhanced interoperability, data management, and analysis methods.
- 3** Partner programs and the NatureServe network will publish citizen science data in formats that **document, visualize, and communicate** trends in the status and condition of species and ecosystems.
- 4** Citizen science initiatives **expand coverage and improve quality** of data on species and ecosystems that flow into the NatureServe network.

1 SUPPORT, ENGAGE, AND INSPIRE CITIZEN SCIENTISTS TO COLLECT HIGH-QUALITY DATA

Build capacity to increase NatureServe network participation and leadership in citizen science through strategic partnerships, training, education, and outreach.

Expanding the opportunities for collaboration between the NatureServe network and citizen science will help strengthen the usefulness of citizen science data for at-risk species and increase the flow of high quality observations into larger datasets, especially those maintained by NatureServe network members. To be most effective, the NatureServe network will need to:

- Build or strengthen partnerships with existing citizen science initiatives that have an emphasis on scientific rigor and complement our strengths
- Promote citizen science opportunities online and at targeted events to inspire people to get involved with their local member program
- Develop training programs and outreach materials that support the collection of high quality data on at-risk species and all types of ecosystems by partner citizen scientists
- Develop effective ways to motivate citizen scientists through individual recognition, sharing of information and incorporation of their data into online map products
- Secure funding to support these activities.

While NatureServe and network members have been and remain engaged in citizen-science partnerships, the field—and the tools and systems available to it—have matured to a stage where we feel confident in our ability to contribute consistent, systematic value to such initiatives.

Many member programs manage their own citizen data collection projects, either alone or in partnership with others (see *Appendix I*). Partnerships with state and provincial fish and wildlife agencies, in particular, are emerging as opportunities for citizen science initiatives to gather data on species of greatest conservation need. The most established NatureServe engagement is iMapInvasives (see *Box 1*), in which seven network members currently provide trained

volunteers with tools to contribute data about invasive species infestations. NatureServe will continue to support these current citizen science projects and look for opportunities to build on such established successes.

Identifying additional citizen science efforts that align with NatureServe's interests and expertise will require building new and strategic partnerships, including with informal science education experts. As we align with selected existing projects, our goal will be to develop methods that increase data sharing and interoperability while maintaining the same standards of rigorous quality assurance and control.

To develop this on-the-ground capacity, the NatureServe network may need to provide technical training for citizen scientists. Such instruction may take place through partnerships with state and provincial agencies, programs such as Master Naturalists (<http://www.nralliance.org>), or through NatureServe network members. While increasing participants' awareness of survey and data needs, such training programs will focus on practical guidance for specific initiatives.

BOX 1 iMapInvasives

Invasive species are those non-native plants, animals and pathogens that survive and spread outside of cultivation and negatively impact biodiversity, human health, and the economy.

One major challenge to the successful prevention and management of invasive

species is the lack of an effective mechanism for sharing and aggregating data between multiple partners. iMapInvasives is a collaborative partnership that provides a venue for the comprehensive exchange of invasive species data using the latest web-based technologies.

<http://www.imapinvasives.org/>





As we develop and implement the standards, tools, and processes needed to incorporate citizen observations, we will focus on initiatives that align best with our mission. NatureServe and network partners will develop and maintain lists of the highest-priority information needs best suited for data contribution by citizen scientists, including:

BOX 2 Data Quality, Validation, and Interoperability

Although many citizen scientists are highly knowledgeable, data quality and validation is an important component of any citizen science program to ensure that the data are of the highest quality possible. A well-designed project model is crucial for ensuring that the data collected can be used for scientific analyses. Components of a successful project model include clear data collection protocols and data entry forms, and support for participants (Bonney et al. 2009).

Support for participants includes validation of species identification. Partnerships with local teachers, researchers, and experienced amateur scientists can generate a pool of taxon experts who train others and verify observations. The use of “smart filters” and online reviewing tools can both improve data validation and provide timely follow-up with contributors (Bonter and Cooper 2012). The development of volunteer approaches to rating participants (iSpot, in its pioneering efforts to measure and publicize “reputation,” may be the leader—see <http://www.ispot.org.uk/help-reputation>) and filtering outliers (for which the approaches developed by iNaturalist for self- and peer-feedback are particularly impressive) are worth highlighting in this respect.

Numerous online sources provide tools and digital infrastructure along with information and support for project developers and participants, including:

- The Cornell Lab of Ornithology’s Citizen Science Central (<http://www.birds.cornell.edu/citscitoolkit>)
- DataONE: the Data Observation Network for Earth (<http://www.dataone.org>)
- iNaturalist (<http://www.inaturalist.org>)
- CitSci.org (<http://www.citsci.org>)
- SciStarter.com (<http://www.scistarter.com>)

- At-risk species facing known threats or population declines
- Problematic invasive non-native species
- Observations of distinct ecosystem types

Other activities may focus more on engagement and inspiration. For example, **ConservationWalks** (<https://connect.natureserve.org/support-us/conservationwalks>) is a NatureServe outreach program that encourages students, corporate staff, and community volunteers to conduct nature hikes using **LandScope America** (<http://www.landscape.org>) and **NatureServe Explorer** (<http://www.natureserve.org/explorer>) while raising funds for NatureServe. Creating a citizen science component to this program could strengthen individuals’ direct connections to NatureServe in addition to generating observation data (Indiana University 2012).

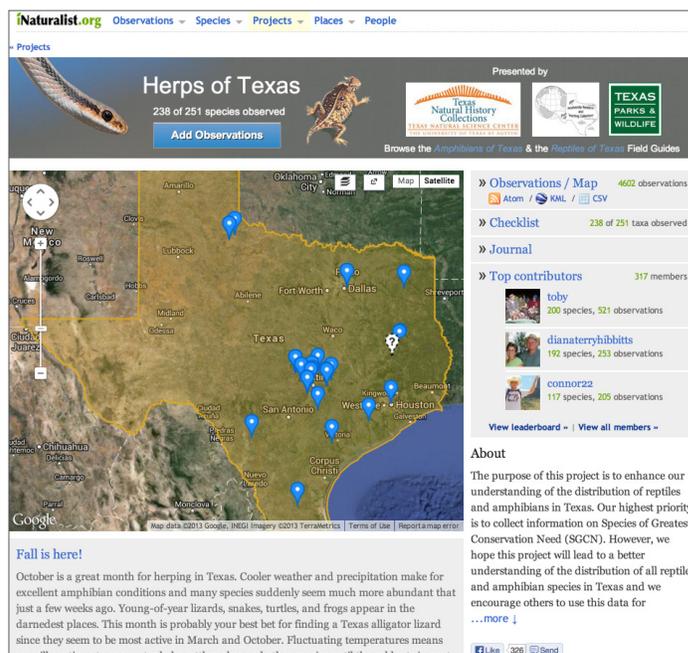


Figure 2. NatureServe is collaborating with Texas Parks and Wildlife and iNaturalist to enable the transfer of data collected by citizen scientists on reptiles and amphibians into NatureServe’s Biotics observation module.

Core Activities

- Pursue partnership opportunities with individuals, groups, and existing citizen science programs based on well-defined standards for partnership.
- Recruit network members to raise funds needed to expand iMapInvasives into their geographies to support invasive species tracking.
- Work with network members to identify high-priority information needs well-suited to citizen observations and coordinate efforts to acquire them.
- Collaborate with network to conduct train-the-trainer workshops that catalyze widespread adoption and dissemination of citizen science tools by partners.
- Partner with one or two groups with considerable public outreach capability to promote our citizen science efforts.
- Showcase the network's citizen science projects on the NatureServe website (see *Figure 2* and *Appendix I*).
- In collaboration with network members, pose recurring field observation challenges to the citizen science community to inspire engagement and share our passion for science.
- Prepare regular updates to the ConservationWalks manual that highlight the most current resources for students and other volunteers who are contributing citizen science data.
- Cultivate strong relationships with funders who support NatureServe's initiatives, especially those focused on education, public engagement, and the need for more, high-quality information for decision-making.

2 IMPROVE THE ABILITY TO DETECT TRENDS WITH CITIZEN SCIENCE OBSERVATION DATA

Assist citizen-science programs in adapting their data standards, methods, and models to ensure the widest possible application of accurate, high-quality citizen-acquired observations.

The greatest potential benefit of data collection by citizen scientists is the sheer number of “boots on the ground” that can effectively scale up the efforts of professional scientists. Many NatureServe network members already use information gathered by citizen scientists to augment their datasets or to direct further research efforts. A January 2013 network survey about engagement with citizen science indicated that more than half of the respondents already monitor existing citizen science platforms for new and interesting observations, with eBird (<http://ebird.org/content/ebird>) being the most popular.

By implementing the strategy described here, we can significantly expand the constructive impacts of citizen science. Through our experience managing and applying large-scale datasets, our suite of existing tools, and our extensive relationships with conservation practitioners and decision-makers, the NatureServe network can facilitate broader, more effective use of citizen science data in applied conservation.

To do so, however, we must develop specific data standards and tools and introduce business processes for integrating citizen science observations with our international datasets for at-risk species, invasive species, ecological systems, and vegetation. This requires that we systematically address issues like:

- Data quality
- Appropriate spatial resolution
- Documentation of inventory effort
- Documentation of absence as well as presence
- Data sensitivity
- Data volume
- Statistical rigor for trend detection



Our decades of experience developing and applying data standards demonstrate NatureServe's capacity to improve the integration of citizen scientists' observations within large international datasets, including our own. For example, the Observation Template Library, developed in collaboration with Parks Canada, can help citizen science programs establish more rigorous data collection standards and make data sharing easier. The direct connection between the Library and NatureServe's core data systems could facilitate easier collection of citizen-science observations by network members.

Core Activities

- Improve the quality of incoming citizen-science data by collaborating with partners to develop (or modify existing) user-friendly data templates and mobile apps aligned with NatureServe observation data standards.
- Develop the functionality to import citizen scientists' datasets into the Biotics observation module (a component of NatureServe's custom biodiversity-data management software) while ensuring the inclusion of data quality-assurance protocols and appropriate metadata.
- With iMapInvasives, partner with regional pest plant councils and other programs to aid in early detection and mapping of high-priority invasive, non-native species.
- Engage with partner citizen science programs to encourage their use of standard data structures for biological information, such as the Darwin Core (which is incorporated within the NatureServe Observation Template Library).

3 USE CITIZEN SCIENCE DATA TO DOCUMENT, VISUALIZE, AND COMMUNICATE BIODIVERSITY TRENDS

Develop data mining, spatial modeling, analysis and visualization techniques that demonstrate the conservation value of citizen science data for highlighting trends in biodiversity.

Citizen science projects reinforce altruistic impulses toward shared responsibility and civic engagement among its participants. Engaging in meaningful scientific activities also empowers them to act not just as consumers, but as active producers of knowledge. By quickly republishing and reporting on the fruit of their efforts, the NatureServe network and its partners can enrich those intangible rewards and offer a sense of achievement.

Citizen scientists have the potential to produce the very large sample sizes needed to detect trends in distribution of species and ecosystems (Schmeller et al. 2008). eBird has been at the forefront of establishing low-cost mechanisms to improve the analytical power of citizen observations to detect change over time or space. Data-entry forms encourage citizen scientists to record time spent in the field, the distance travelled and the number of observers (level of effort), and which species were expected but not seen (true absence data). These ancillary data can greatly improve the applicability of observations for tools like species distribution modeling and trend detection.

We propose to work with existing repositories of citizen science data like iNaturalist, GBIF (<http://www.gbif.org>), and eBird to develop techniques to derive indicators of significant change in species populations and/or distributions over time. These analyses will yield reports and maps on emerging trends, maps showing the spread and risk of invasive species, and time-series observations for at-risk species—all in ways that can help guide land-use decisions. As NatureServe's core datasets grow with new citizen science observations, we will further develop analytical and visualization methods with the specific objective of detecting overall trends in species of conservation concern, widely distributed but rapidly declining species, and species facing fast-moving threats.

Using multiple publishing channels, including social media and our redesigned website, we can raise awareness of the growing contributions of citizen science to NatureServe's work. We will display observation data collected by our citizen science partners using online resources like:

- **NatureServe Explorer** (<http://www.natureserve.org/explorer>), our online knowledge base on species and ecosystems (see *Box 3*);
- **LandScope America** (<http://www.landscape.org>), an online conservation priority system (see *Figure 3*)
- **Wikitawa** (forthcoming), a field guide to natural communities in the U.S. national parks

With the results of their efforts published through these publicly accessible platforms, citizen scientists will gain the satisfaction of seeing their contributions reported back and included among other important and meaningful data, maps, and resources. Other strategies may focus on providing immediate feedback to contributors by displaying observations as they are submitted and providing real-time counters that show how many observations the citizen science community submits to specific challenges and projects.

Core Activities

- Using an existing repository of citizen science observation data, conduct pilot projects to:
 - Develop data-mining techniques that have robust methods for deriving indicators of significant change in species populations and/or biodiversity distributions over time
 - Develop visualization products and summary statistics for species and ecosystems tracked by the NatureServe network
 - Use data-mining techniques to analyze and publish information about emerging trends for species and habitats of concern
- Make information easily accessible for practitioners, policy-makers, and citizens by publishing citizen-science data on web resources like NatureServe Explorer and LandScope America.
- Use data-mining techniques to create national and international views of invasive species work in iMapInvasives

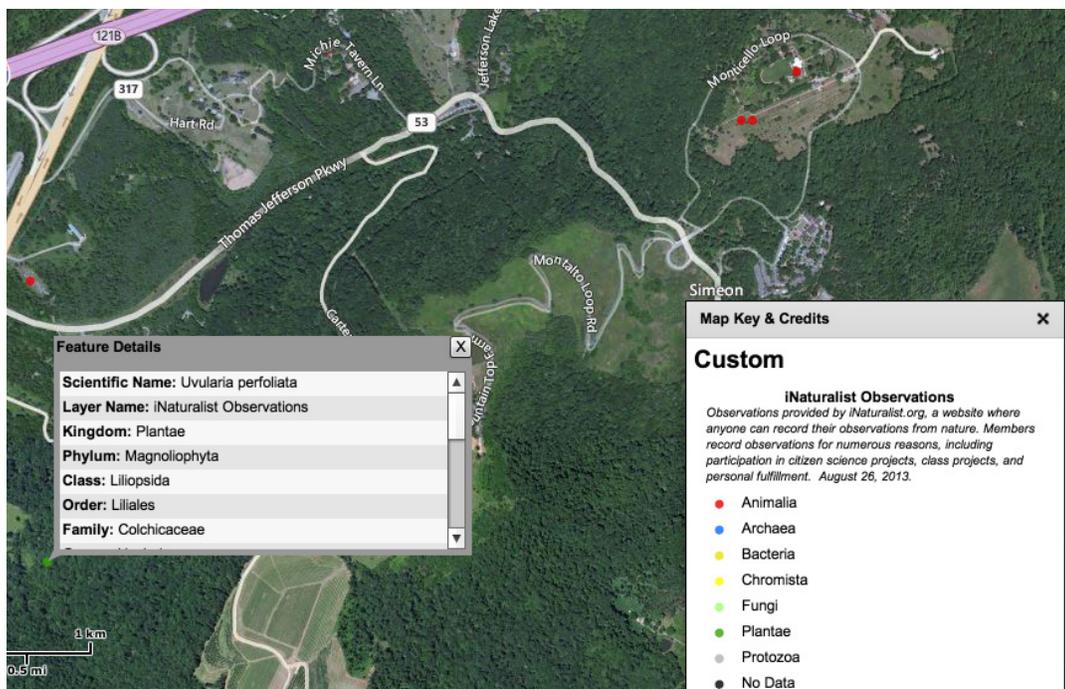


Figure 3. NatureServe currently publishes a map layer comprising observations from iNaturalist on LandScope America (detail at left). <http://j.mp/iNat-LSA>



4 ENHANCE QUALITY AND COVERAGE OF CITIZEN SCIENCE DATA ON SPECIES AND ECOSYSTEMS

Support the citizen science community by providing knowledge and maps that strengthen the overall quality of citizen science observations.

Citizen scientists can use existing data and maps from the NatureServe network to help guide their data-collection efforts and ensure they are looking for the right species in the right places. For example, NatureServe Explorer (see Box 3) provides citizen scientists with detailed information on more than 66,000 species and 6,800 habitats. LandScape America uses this resource to generate lists of species for survey areas and provide citizen scientists crosslinks to meticulously detailed knowledge about what to look for in a given area. NatureServe Explorer provides easy access to information on extinction risk as well as range maps—in addition to the GIS range maps that NatureServe and its partners publish for many species groups (like birds, mammals, and amphibians).

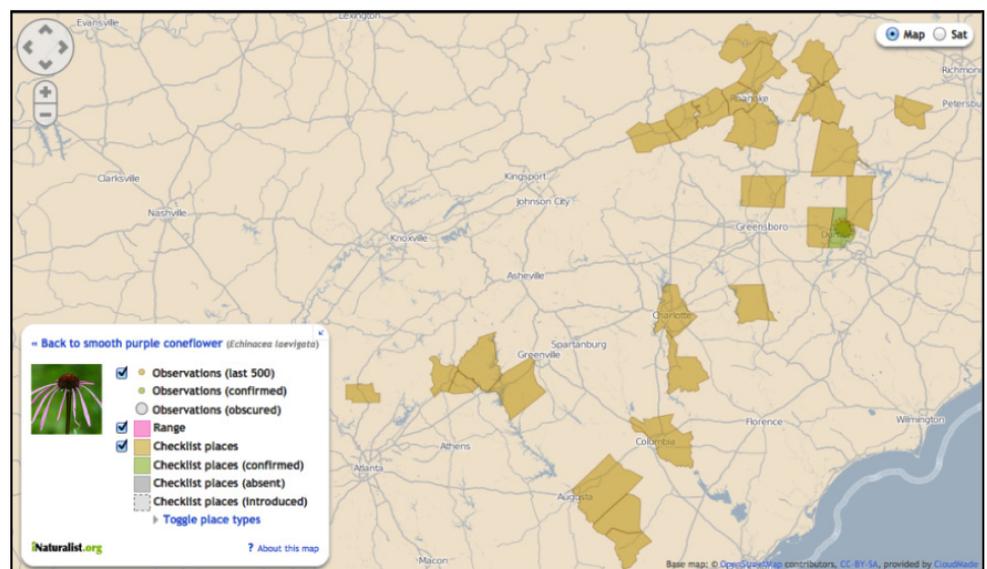
Citizen science initiatives can leverage this authoritative knowledge to improve the quality of their own observations—whether by flagging “out of range” observations that could represent either errors in species identification, or range expansions that merit further professional review and attention. And once absence data are incorporated into project data models, failure to document species observations in an

area where they would normally be expected to occur may detect a reduction in range or species abundance (see Figure 4).

Citizen scientists can also retrieve information and maps about ecosystems known to occur in a survey area, as well as species of concern they likely contain. The NatureServe Terrestrial Ecological Systems Classification (Comer et al. 2003, Josse et al. 2003) and the U.S. National Vegetation Classification (FGDC, 2008) can help citizen scientists direct inventory efforts and identify likely target species. By adding to existing knowledge systems, citizen scientists can advance our collective understanding of ecosystem composition and the relationships between species and habitats—as, for example, when new observations of a species in an ecosystem where it was previously unknown might reveal how species ranges are shifting in a changing climate.

As outlined above, NatureServe regional and network staff can coordinate with regional partners to identify high-priority information needs that citizen scientists can help address. Taken together, increasing access to existing scientific resources can improve quality-control procedures for citizen science projects—and, in turn, quickly generate data to keep range maps current in an era of rapid ecological change.

*Figure 4. Citizen science projects like iNaturalist (right) can use maps of NatureServe county-level species data for smooth purple coneflower (*Echinacea laevigata*) to help its users see where a species is already known to occur. Observations outside of this range could reflect errors in species identification or new discoveries, just as failure to find observations in shaded areas could reflect a reduction in the range.*



Core Activities

- Partner with existing citizen science programs to target and collect species observations that reevaluate occurrence viability of known populations
- Develop a pilot project for citizen scientists that assesses trends in the condition of ecosystems by reviewing accuracy of vegetation maps or providing georeferenced photo documentation of pre-determined sample sites.
- Integrate research-grade citizen science data into NatureServe's international datasets
- Publish web services of species ranges and ecosystem maps that citizen science programs can integrate to facilitate data entry and quality control by:
 - Generating checklists (and linked photos) of target species likely to be present at a given place and time to assist with species identification
 - Encouraging surveys in areas within the range of specific species, but where no documented observations yet exist
 - Providing a mechanism to build a better understanding both of the species present in an ecosystem and of species-habitat relationships
- Provide information on hotspots of current data collection activity to guide targeted inventory efforts
- Publish ecosystem data in iMapInvasives to provide context for the assessment of ecological impacts of invasive species
- Expand beyond invasive species observations to include other biodiversity threat information valuable to conservation decision making, such as localized dams and water diversions, or off-road vehicle use areas

BOX 3 NatureServe Explorer

NatureServe Explorer is an online, searchable database that details the life history and habitat requirements of thousands of species and the characteristics of ecosystems, as well as the threats they face and management strategies for their protection.

Distribution maps show where each species and ecological community occurs as well as how rare or common it is in each state and province. NatureServe Explorer also includes detailed range maps for all birds and mammals that occur in both North America and Latin America.



Widely used by scientists and researchers interested in its meticulously detailed species and habitat information, NatureServe Explorer also allows planners and natural resource managers to assess conservation needs and determine possible courses of management action.

Citizens can also make use of this free, publicly available resource to answer questions like:

- What mammals are found in my state? Which of them are endangered?
- How many U.S. orchids are rare or threatened? What is threatening the prairie white-fringed orchid? What are its habitat requirements?
- What species of birds are found in Nova Scotia?
- How many native fish species are extinct or missing in the North America? Where did each one previously occur?



HELPING CITIZEN SCIENCE GUIDE CONSERVATION

Collaborations between citizen and professional scientists that focus on observing, measuring, and monitoring environmental phenomena offer an unprecedented means of transforming the scientific enterprise needed to guide effective conservation. As these projects expand scientific knowledge, capacity, and literacy, its amateur participants enrich their enjoyment and understanding of the natural world, gain hands-on experience in conducting scientific investigations, and become equipped to engage productively in conservation policy and decision-making settings.

During our nearly 40-year history, the NatureServe network has combined applied expertise and on-the-ground experience to amass credible, reliable knowledge on biodiversity that serves local, regional, national, and global conservation needs. By disseminating this information to practitioners and decision-makers within government agencies, NGOs, and private corporations, NatureServe has established relationships that routinely bring its knowledge to bear on the world's greatest conservation challenges.

When paired with recent advances in network and computing technologies, the unique structure and expertise of the NatureServe network can increase the profile and application of citizen science in on-the-ground conservation. NatureServe's science and data experts can help maximize the quality of citizen-acquired data that broaden our understanding of threats to biodiversity—like habitat loss, invasive species, urban sprawl, and climate change—and how they are altering environments worldwide. By establishing greater connections between citizen scientists and conservation practitioners, the NatureServe network can help ensure that the selfless impulses that prompt citizen scientists to action are rewarded with improved conservation priorities and outcomes.



To advance the recommendations outlined this strategy, NatureServe staff must take several near-term steps, among them developing a business implementation strategy, identifying the attributes of the most promising collaborations, and building the partnerships needed to carry out successful projects. Continuing work on the network's complement of current citizen science projects will also provide critical intelligence on how best to create consistent “off-the-shelf” projects that are sufficiently flexible and scalable to adapt to the varied capacities and responsibilities of the network's diverse members.

We firmly believe that, by working alongside citizen scientists and the organizers of such initiatives, we will empower communities to identify and commence the actions most needed to combat the greatest threats and protect the highest priority plants, animals, and places.

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APPENDIX I—Citizen Science Across the Network

The table below shows a sampling of NatureServe network engagement with citizen science initiatives:

Network Member	Project	URL
Alabama Natural Heritage Program	Black Bear Sighting Database	www.alnhp.org/Black_Bear_DB.php
	Citizen Data Submissions	www.alnhp.org/contributing_data.php
Alaska Natural Heritage Program	Alaska Bat Monitoring Project	aknhp.uaa.alaska.edu/zoology/citizen-science/alaska-bat-project
	Alaska Wood Frog Monitoring Project	aknhp.uaa.alaska.edu/zoology/citizen-science/alaska-wood-frog-monitoring
	Alaska Loon & Grebe Watch Monitoring Program	aknhp.uaa.alaska.edu/zoology/citizen-science/alaska-loon-grebe-watch
Alberta Conservation Information Management System	Citizen Data Submissions	albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims)/submit-data.aspx
Arizona Heritage Data Management System	iMapInvasives	imapinvasives.org/azimi/map
Arkansas Natural Heritage Program	Citizen Science Resources	www.naturalheritage.com/citizen-science/default.aspx
Atlantic Canada Conservation Data Centre	Maritimes Butterfly Atlas (MBA)	accdc.com/butterflyatlas/About.html
	Citizen Data Submissions	www.accdc.com/Data/submit.html
British Columbia Conservation Data Centre	Citizen Science on E-Fauna BC: Mapping Photo Records	www.geog.ubc.ca/biodiversity/efauna/E-FaunaCitizenSciencePhotoMapping.html
	E-Flora Photos as Citizen Science: Mapping Your Photo Records	www.geog.ubc.ca/biodiversity/eflora/CitizenSciencePhotoMapping.html
	Breeding Bird Atlas	www.birdatlas.bc.ca/english/index.jsp
	Citizen Data Submissions	www.env.gov.bc.ca/cdc/contribute.html
	B.C. Frogwatch	www.env.gov.bc.ca/wld/frogwatch/index.htm
	Wildlife Health	www.env.gov.bc.ca/wld/wldhealth
	General Wildlife Observation Submissions	a100.gov.bc.ca/pub/cwi/spi_wsf.MainPage
California Natural Diversity Database	Fish and Mussel Data Submissions	www.env.gov.bc.ca/fish_data_sub/index.html
	Citizen Data Submissions	www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp
Colorado Natural Heritage Program	Volunteering Prospects	www.cnhp.colostate.edu/jobs/volunteer.asp
	Native Plant Master™	www.extension.colostate.edu/jefferson/npm/npm.shtml
	Adopt-a-Rare-Plant Program	catalog.botanicgardens.org/DateSelect.aspx?item=1052
	Citizen Data Submissions	www.cnhp.colostate.edu/exchange/submit.asp#fieldform
Connecticut Natural Diversity Database	New England Wildflower Society's Plant Conservation Volunteers	www.newenglandwild.org/conserves/collaborations/pcvs
Delaware Natural Heritage Program	Adopt-a-Wetland	www.dnrec.delaware.gov/Admin/DelawareWetlands/Pages/AdoptaWetland.aspx
	Citizen Osprey Monitoring Program	www.dnrec.delaware.gov/fw/Volunteers/Pages/COMP.aspx
	Delaware Amphibian Monitoring Program	www.dnrec.delaware.gov/fw/Volunteers/Pages/DAMP.aspx
	Delaware Shorebird Project	www.dnrec.delaware.gov/fw/Shorebirds/Pages/Default.aspx
	Piping Plover Volunteer Program	www.dnrec.delaware.gov/fw/Volunteers/Pages/pipingplover.aspx

Network Member	Project	URL
Delaware Natural Heritage Program (cont.)	Volunteer at a Wildlife Area!	www.dnrec.delaware.gov/fw/Volunteers/Pages/WildlifeAreas.aspx
	Delaware's Bat Program	www.dnrec.delaware.gov/fw/bats/Pages/Default.aspx
SalvaNATURA (El Salvador)	Programa Comunidades y Biodiversidad: Educando Líderes Ambientales	salvanatura.org/index.php?option=com_content&task=view&id=158&Itemid=328
	Volunteer in Scientific Research	salvanatura.org/index.php?option=com_content&task=view&id=235&Itemid=333
Florida Natural Areas Inventory	iMapInvasives	imapinvasives.org/flimi/map
Georgia Nongame Conservation Section	North American Amphibian Monitoring Program (NAAMP)	georgiawildlife.com/node/1329
	Anabat	www.georgiawildlife.org/AnabatProject
Idaho Natural Heritage Program	Multi-Species Baseline Initiative (MBI)	fishandgame.idaho.gov/content/post/citizen-science-and-mbi
	Idaho Master Naturalist	fishandgame.idaho.gov/sites/Wildlife/IDMasterNaturalist/default.aspx
Illinois Natural Heritage Database Program	Plants of Concern – A Citizen Science Rare Plant Monitoring	www.plantsofconcern.org
Kansas Natural Heritage Inventory	National Phenology Network	www.usanpn.org
Kentucky Natural Heritage Program	Volunteer Opportunities	naturepreserves.ky.gov/aboutus/Pages/jobs.aspx
Louisiana Natural Heritage Program	Louisiana Master Naturalist Program	www.louisianamasternaturalist.org
Maine Natural Areas Program	New England Wildflower Society's Plant Conservation Volunteers	www.newenglandwild.org/conserv/collaborations/pcvs
Manitoba Conservation Data Centre	Report a Rare Species	www.gov.mb.ca/conservation/cdc/report.html
	The Manitoba Breeding Bird Atlas	www.birdatlas.mb.ca
	The Manitoba Herps Atlas	www.naturenorth.com/Herps/Manitoba_Herps_Atlas.html
Maryland Natural Heritage Program	Amphibian and Reptile Atlas	webapps02.dnr.state.md.us/mara/default.aspx
Massachusetts Natural Heritage and Endangered Species Program	New England Wildflower Society's Plant Conservation Volunteers	www.newenglandwild.org/conserv/collaborations/pcvs
Michigan Natural Features Inventory	Midwest Invasive Species Information Network	www.misin.msu.edu
	Michigan Conservation Stewards Program	mnfi.anr.msu.edu/education/stewards.cfm
	Michigan Vernal Pools Mapping & Monitoring Program	
	Eastern Massasauga Population Monitoring	
Minnesota Natural Heritage & Nongame Research	Minnesota Frog and Toad Calling Survey	www.dnr.state.mn.us/volunteering/frogtoad_survey/index.html
	Loon Monitoring	www.dnr.state.mn.us/eco/nongame/projects/mlmp_state.html
	Rare Mammals Sighting Reports	www.dnr.state.mn.us/mbs/index.html
Missouri Natural Heritage Program	Report a Bear Sighting	mdc.mo.gov/discover-nature/wildlife-reporting/bear-reports
	Report a Mountain Lion Sighting	mdc.mo.gov/discover-nature/wildlife-reporting/mountain-lion-reports
	CACHE/SPARKS	www.mobirds.org/CACHE
	Missouri Master Naturalist	extension.missouri.edu/masternaturalist
	Road Cruising for Turtles	
	North American Amphibian Monitoring Program	www.pwrc.usgs.gov/naamp
	Missouri Stream Team	www.mostreamteam.org



Network Member	Project	URL	
Montana Natural Heritage Program	Citizen Data Submissions	mtnhp.org/observations.asp	
Nebraska Natural Heritage Program	Nebraska Master Naturalist Program	snr.unl.edu/naturalist	
New Hampshire Natural Heritage Bureau	New England Wildflower Society's Plant Conservation Volunteers	www.newenglandwild.org/conserves/collaborations/pcvs	
New Jersey Natural Heritage Program	Wildlife Conservation Corps (WCC)	www.state.nj.us/dep/fgw/wcchome.htm	
New York Natural Heritage Program	Citizen Data Submissions	www.dec.ny.gov/animals/91024.html	
	iMapInvasives	imapinvasives.org/nyimi/map/	
North Carolina Natural Heritage Program	Citizen Data Submissions	www.ncnhp.org/web/nhp/contribute-to-nhp-database	
	Albemarle-Pamlico National Estuary Program's (APNEP) Citizens' Monitoring Network	portal.ncdenr.org/web/apnep/cmn	
Northwest Territories Conservation Data Centre	NWT Species	www.facebook.com/#!/groups/NWTSpecies/	
	NWT Species at Risk Stewardship Program	nwtspeciesatrisk.ca/tiki/tiki-index.php?page=StewardshipProgram	
	NWT Cumulative Impact Monitoring Program	www.aadnc-aandc.gc.ca/eng/1100100027498/1100100027499	
	Northwest Territories/Nunavut Bird Checklist Survey	www.ec.gc.ca/reom-mbs/default.asp?lang=En&n=60E48D07-1	
	Report Wildlife Sightings	mailto:WildlifeOBS@gov.nt.ca	
	Providing Wildlife Observations to the Wildlife Management Information System	www.enr.gov.nt.ca/live/pages/wpPages/WMIS_Submit_Data.aspx	
Oklahoma Natural Heritage Inventory	Volunteer Opportunities	www.biosurvey.ou.edu/opportun.html	
	Oklahoma BioBlitz!	www.biosurvey.ou.edu/bioblitz/BioBlitz.html	
Ontario Natural Heritage Information Centre	Atlas of Ontario Odonata		
	eBird	ebird.org/content/ebird	
	Frogwatch Ontario	www.naturewatch.ca/english/frogwatch/on	
	Migratory Dragonfly Partnership	www.migratorydragonflypartnership.org	
	Marsh Monitoring Program	www.bsc-eoc.org/mmp/tell.html	
	North American Butterfly Association Butterfly Counts	www.naba.org	
	Ontario Butterfly Atlas	www.ontarioinsects.org/atlas_online.htm	
	Ontario Reptile and Amphibian Atlas	www.ontarionature.org/protect/species/herpetofaunal_atlas.php	
	Ontario Turtle Tally	www.torontozoo.com/adoptapond/turtleatally.asp	
	Christmas Bird Counts	www.bsc-eoc.org/volunteer/cbc/index.jsp?targetpg=index&lang=EN	
	Project Feederwatch	feederwatch.org	
	Oregon Biodiversity Information Center	iMapInvasives	www.imapinvasives.org/orimi/map
		Citizen Data Submissions	orbic.pdx.edu/data-submit.html
ANCON (Panama)	Volunteer	www.ancon.org/index.php?option=com_content&view=article&id=86:programa-de-voluntarios&catid=82:educacion-ambiental&Itemid=216	
Pennsylvania Natural Heritage Program	iMapInvasives	imapinvasives.org/paimi/map	

Network Member	Project	URL
Centre de Données sur le Patrimoine Naturel du Québec	Citizen Data Submissions	www.cdpnq.gouv.qc.ca/espece.htm
Saskatchewan Conservation Data Centre	Citizen Data Submissions	www.biodiversity.sk.ca/OnlineRep.htm
South Dakota Natural Heritage Program	Citizen Data Submissions	gfp.sd.gov/wildlife/threatened-endangered/default.aspx
	Wildlife Diversity Small Grants Program	gfp.sd.gov/wildlife/funding/wildlife-diversity-small-grants.aspx
Texas Parks & Wildlife Department	Texas Nature Trackers	www.tpwd.state.tx.us/trackers
	Texas Master Naturalist	txmn.org
Vermont Nongame & Natural Heritage Program	New England Wildflower Society's Plant Conservation Volunteers	www.newenglandwild.org/conserv/collaborations/pcvs
	iMapInvasives	imapinvasives.org/vtimi/map
Virginia Natural Heritage Program	iMapInvasives	imapinvasives.org/vaimi/map
	Virginia Master Naturalists	www.virginiamasternaturalist.org
Washington Natural Heritage Program	RareCare	courses.washington.edu/rarecare
Wisconsin DNR Bureau of Endangered Resources	Wisconsin Citizen-based Monitoring Network	wiatri.net/cbm/index.cfm
	Citizen Data Submissions	dnr.wi.gov/topic/EndangeredResources/forms.html#field
	Karner Blue Butterfly Recovery Project	dnr.wi.gov/topic/ForestPlanning/karner.html
Wyoming Natural Diversity Database	WyoBio – The Wyoming Biodiversity Citizen Science Initiative	wyobio.wygisc.org
Yukon Conservation Data Centre	Citizen Data Submissions	www.env.gov.yk.ca/animals-habitat/cdc.php
NatureServe	iNaturalist	www.inaturalist.org
	GBIF: The Global Biodiversity Information Facility	www.gbif.org
	National Phenology Network	www.usanpn.org
	iMapInvasives	www.imapinvasives.org
NatureServe Canada	eButterfly	www.ebutterfly.ca
	eBird Canada	ebird.org/content/canada
	Canadian Wildlife Federation	cwf-fcf.org/en



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