

CDI FY17 Request for Proposals

Automating the use of citizen scientists' biodiversity surveys in iNaturalist to facilitate early detection of species' responses to climate change

Submission Title: Automating the use of citizen scientists' biodiversity surveys in iNaturalist to facilitate early detection of species' responses to climate change

Lead PI: Erin Boydston

Mission Area: Ecosystems

Region: Pacific Region

Organization: San Diego Field Station, WERC

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Co-PIs and Collaborators:

Type: CO-PI

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Mission Area: Climate and Land-Use Change

Region: Northeast Region

Organization: Northeast Climate Science Center

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Type: Collaborator

Name: Jennifer Briggs

Mission Area: Climate and Land-Use Change

Region: Southwest Region

Organization: Geosciences and Environmental Change Science Center

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Type: Collaborator

Name: Vijay Barve

Mission Area: Not Applicable

Region: Southeast Region

Organization: Florida Museum of Natural History

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Type: Collaborator

Name: Lena Lee

Mission Area: Not Applicable

Region: Pacific Region

Organization: National Park Service

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Science Support Framework Element 1: Data Management

Science Support Framework Element 2: Science Data Lifecycle - Analysis

Science Support Framework Element 3: Knowledge Management

In-Kind Match: \$17,108.00

List of anticipated deliverables from the project: 1. Databases and interactive maps for 100 National Parks based on 2016 BioBlitz surveys that identify detections of new species and apparent climate-related shifts in species' ranges or habitats 2. Automated data processing system and users' guide to enable future analyses of citizen science biodiversity data collected in iNaturalist or other social media platforms 3. Manuscript describing methods and results for submission to open-access peer-reviewed journal

Lead Cost Center: Western Ecological Research Center

Notes, Comments:

Project Description: Climate and land use change bring major challenges for understanding and predicting impacts on species of conservation concern. We propose to create an automated methodology by which the National Park Service (NPS) can update its biodiversity survey information and species lists. Information collected by citizen scientists in the program iNaturalist can be used to improve and continuously update NPSpecies databases, as we found in a successful recent pilot study of 3 parks using manual assessment methods. Expanding and automating the integration of these datasets across 100 National Parks, and providing interactive maps of new species observations to NPS, will facilitate early detections of species' shifts in range or habitat due to changing climate patterns or other stressors.

Total Budget: \$29,939.00

10/14/2016 CDI Statement of Interest and Project Summary

Title: Automating the use of citizen scientists' biodiversity surveys in iNaturalist to facilitate early detection of species' responses to climate change

PI: Erin Boydston, Western Ecological Research Center, Ecosystems Mission Area

Collaborators: Toni Lyn Morelli, Northeastern Climate Science Center, USGS; Jenny Briggs, Geosciences and Environmental Change Science Center, Southwest Region, CLU Mission Area, USGS; Lena Lee, Santa Monica Mountains National Recreation Area, California, NPS; Vijay Barve, Florida Museum of Natural History

Scope: As patterns of land use and climate continue to change in North America, countless species of plants and animals respond by moving into new ranges, elevations, or habitat types. These shifts can have major consequences for the conservation and stewardship of biodiversity, but detecting shifts in real time is an enormous challenge for resource management agencies. Often, a species is already under stress or at risk by the time its range shift becomes apparent. With the availability of new technology, citizen scientists may be able to help. Recently, National Parks hosted "BioBlitz" surveys in which visitors used the iNaturalist app on mobile devices to document species they observed in parks. The resulting datasets are spatially accurate due to global positioning systems (GPS) and biologically accurate after checks by specialists, representing an unprecedented resource for assessments of biodiversity. With further processing, integration, and analysis, these data could be translated into knowledge that prompts action, but such steps fall outside the current capacity of the National Park Service (NPS) and existing USGS programs. We propose developing a process to rapidly integrate and evaluate existing information on species' ranges and distributions with these new documentations of species in the iNaturalist database. These assessments will permit early detection of species' range shifts in response to changes in climate and land use; facilitate proactive conservation actions by DOI and other agencies; and meet major objectives of the Ecosystems and Climate & Land Use mission areas as well as the DOI Climate Science Centers.

Technical Approach: We will build a methodology and toolset to integrate and cross reference existing species' range and distribution information (e.g. NPS surveys, ICUN range maps, etc.) with new species documentations added to iNaturalist. We will start with iNaturalist records entered during BioBlitz surveys in nearly 100 National Park units during 2016, and expand the scope of our effort as appropriate beyond NPS boundaries and other biodiversity social media platforms (e.g. eBird). Our data process will build from code written in the R statistical package to extract and analyze data from iNaturalist and add steps to cross-reference each observation's location with the most complete available species' distribution information. Results of analyses will be new databases and maps identifying potential climate migrants (i.e. individuals observed at or beyond the northernmost or highest-elevation edge of their range), and species that appear to be undergoing other forms of habitat shifts, displacements, or adaptations to new environments. These products will be provided to NPS and other partner agencies in an interactive online format to facilitate knowledge sharing and possible conservation actions, representing full progress through the science data lifecycle.

Project Experience and Collaboration: Our approach will build on our successful 2016 pilot study. With partners at the Santa Monica Mountains National Recreation Area, National Geographic, and the University of Massachusetts, we used a manual process to download and analyze data from iNaturalist and cross-reference known biodiversity lists with species detected during the 2016 BioBlitz. We identified 27 unprecedented observations of plants, amphibians, and birds at novel locations for 3 focal parks alone. Our proposed CDI project would develop a general automated process that can be used in future years to compare detections from BioBlitzes or other citizen science efforts to existing species distribution databases and maps and apply it to the remaining 90+ 2016 Bioblitz parks. CDI funding would permit the development of specialized and automated processing tools with a collaborator highly

experienced in this field, generating accurate maps and products that represent actionable knowledge for managers charged with the stewardship of thousands of species across more than 100 Parks.

Sustainability: All data sources will be managed and documented with appropriate metadata in ScienceBase according to the FY17 requirements in the Office of Science Quality and Integrity Instructional Memoranda. We will prepare user guides and reports describing our process, tools, and products such that they can be used and applied by others. R code that analyzes iNaturalist and other citizen scientist-derived databases will be made freely available, and a manuscript describing our methods and results will be prepared for submission to a peer-reviewed, open access journal.

Budget justification: Salary for Briggs and Morelli will be contributed to the project as federal matching funds; we request salary for Boydston, Lee, a graduate student research assistant, and collaborator Barve (computer scientist contractor who will develop, test, run, and refine the code used to integrate data sources, and develop interactive web-based map tools to share with NPS).

Timeline

| April | May-June | July | Aug | September |
|--|--|--|--|---|
| Project planning; iNat data QA/QC; Assembly of all known species data for 10 parks | Code development; Testing of code and analysis of pilot data | Expansion of data integration and analysis process for 100 total parks | Scope expansion of approach to new platforms/areas; begin to draft publication based on findings | Prepare online interactive maps of 2016 species' range shift results for NPS partners |

| Budget Category | Federal Funding "Requested" | Matching Funds "Proposed" |
|---|-----------------------------|---------------------------|
| 1. SALARIES (including benefits) | | |
| Federal Personnel Total: | 9000 | 10800 |
| Collaborator/Contract Personnel Total: | 13000 | |
| Total Salaries: | 22000 | 10800 |
| 2. TRAVEL EXPENSES: | | |
| Travel Total (Per Diem, Airfare, Mileage/shuttle) x # 1 Trip to CDI event | 1800 | 800 |
| Other travel expense (registration fees): | | |
| Total Travel Expenses: | 1800 | 800 |
| 3. OTHER DIRECT COSTS (itemize): | | |
| Equipment | | 1000 |
| Publication costs | | 1000 |
| Supplies | | |
| Total ODCs: | 0 | 2000 |
| Net Total | 23800 | 13600 |
| Indirect Costs (WERC 25.795%) | 6139 | 3508 |
| GRAND TOTAL: | 29939 | 17108 |