

Current Applications and Future Potential of Citizen Science Data

Brittany M. Mason and
Corey T. Callaghan

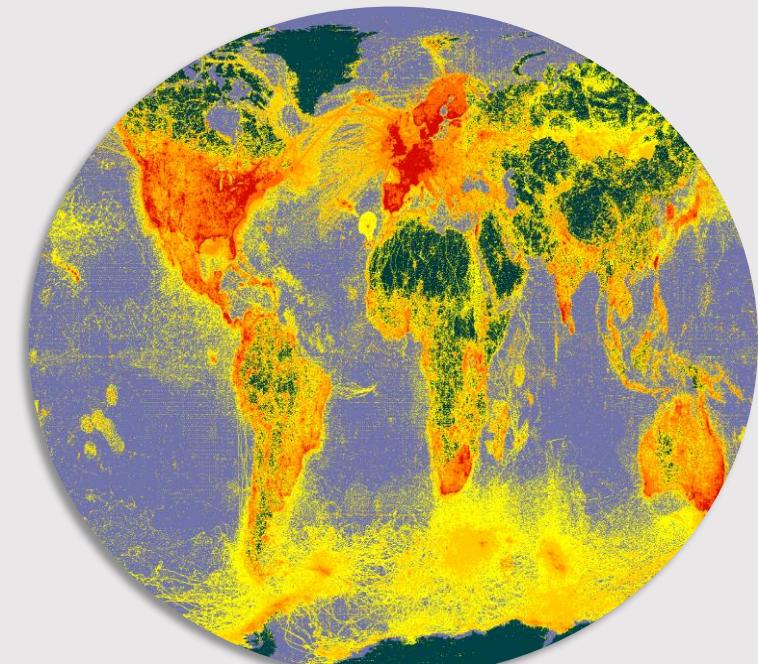


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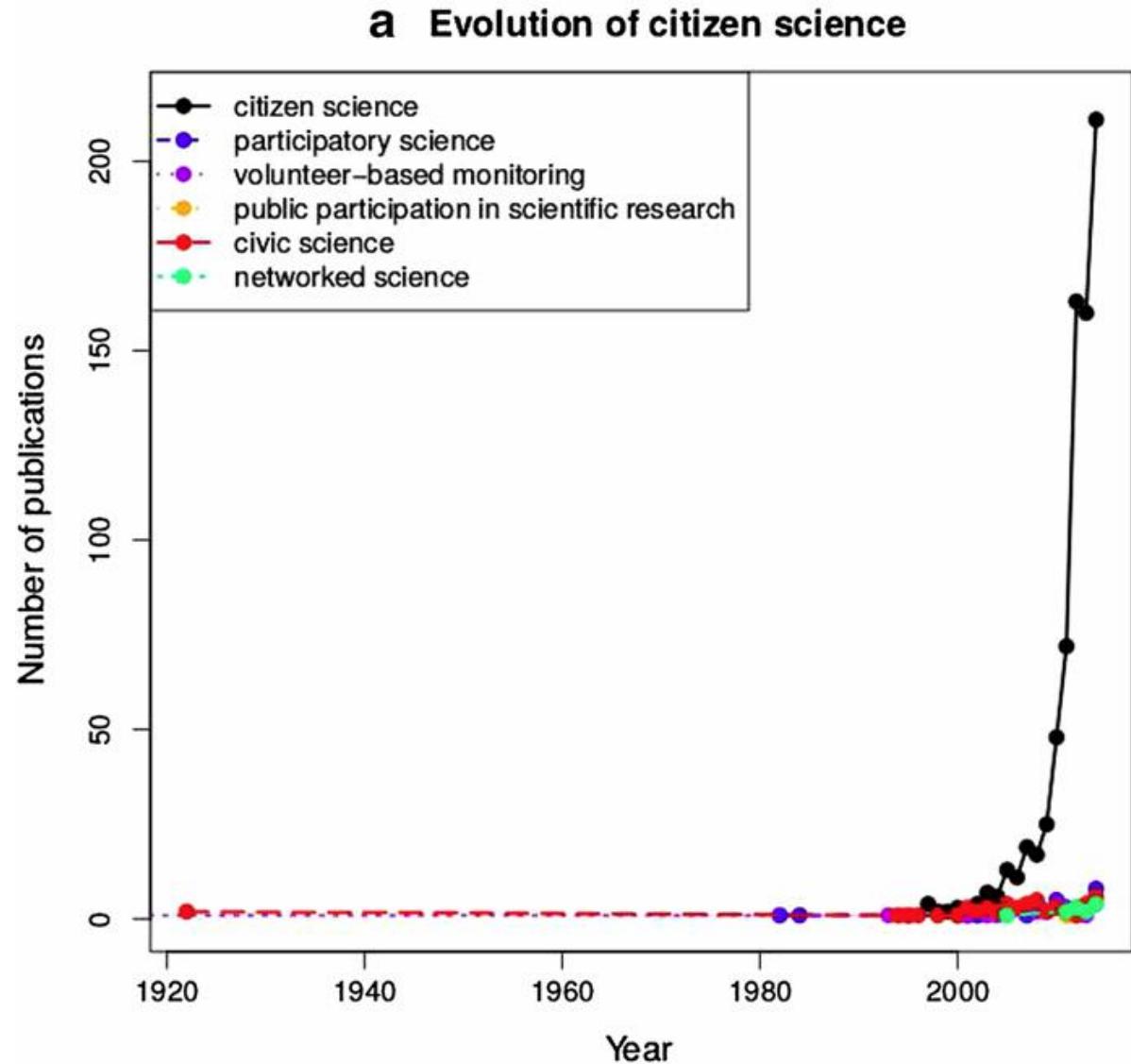
What is Citizen Science?

- Also commonly referred to as participatory science or community science
- Involves public engagement, education, and data collection
- Citizen science programs are interdisciplinary and result in scientific advancement

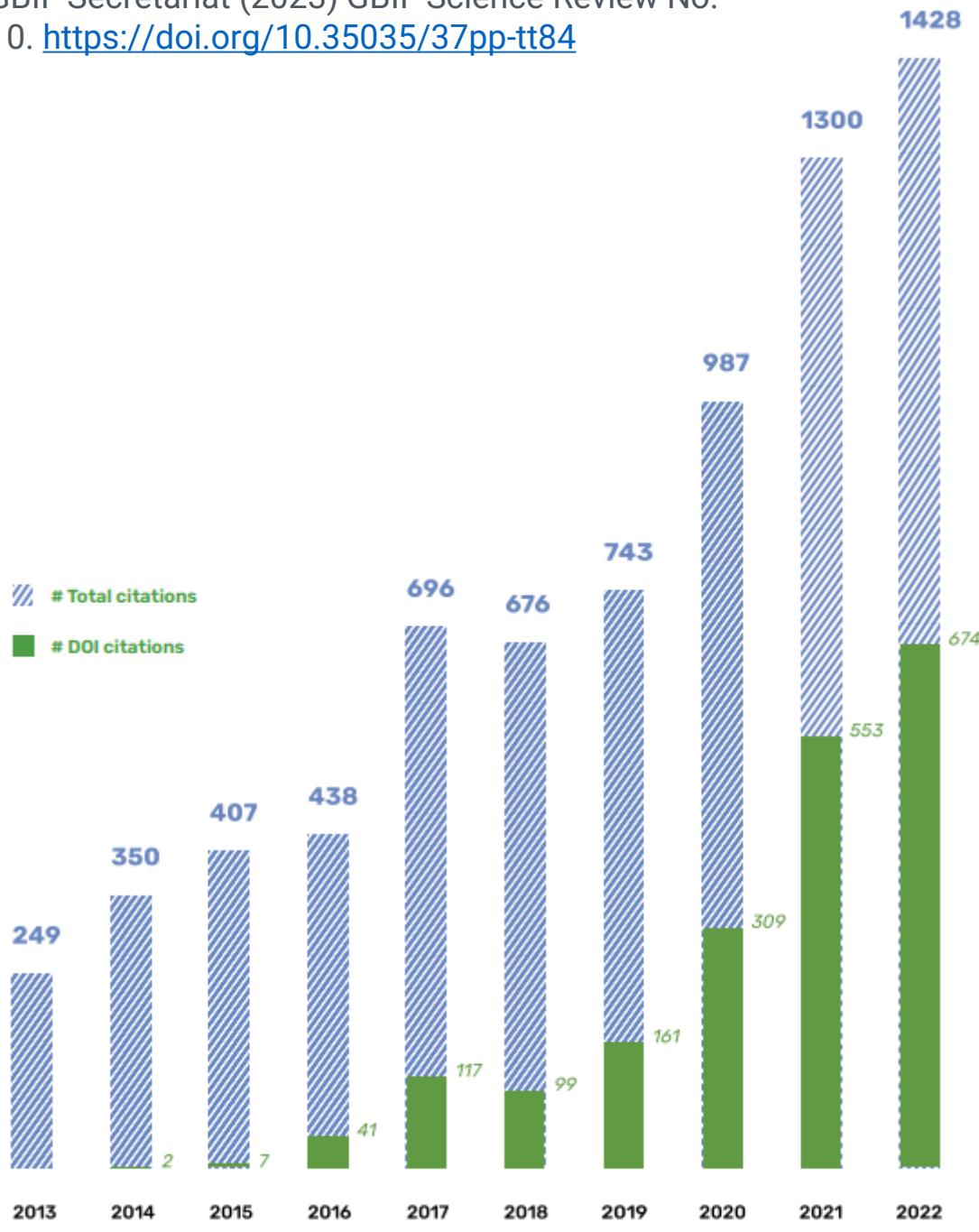


A Growing Field

Advancements in technology has made citizen science more popular and accessible



Welvaert, M, and P. Caley. 2016. Citizen surveillance for environmental monitoring: combining efforts of citizen science and crowdsourcing in a quantitative data framework. SpringerPlus 5:1890.



How is Citizen Science Data Being Used?

- Citizen science data is used in published papers and to inform policy
- However, these uses are rarely summarized

[Danaus plexippus ssp. plexippus](#) ↗

>20,000

Literature

Committee, I. (2023) IUCN Red List of Threatened Species

Danaus plexippus ssp. plexippus has most recently been assessed for The IUCN Red List of Threatened Species in 2023. Danaus plexippus ssp. plexippus has been listed as Vulnerable under criteria A2b.

[Report](#)

[Russula alnijorullensis](#) ↗

Literature

Pelissero, D. Maubet, Y. Ranieri, C. Torres, D. Niveiro, N. (2023) IUCN Red List of Threatened Species

Russula alnijorullensis has most recently been assessed for The IUCN Red List of Threatened Species in 2023. Russula alnijorullensis has been listed as Vulnerable under criteria A3c; C2a(ij).

[Report](#)

Research

Study location, species, topics, analysis types, and data role of iNaturalist in the scientific literature.



RESEARCH ARTICLE

iNaturalist as a tool in the study of tropical molluscs

Rafael Masson Rosa^{1,*}, Daniel Caracanhas Cavallari¹, Rodrigo Brincalene Salvador²

¹ Departamento de Biologia, Universidade de São Paulo, Ribeirão Preto, São Paulo, Brazil
Papa Tongarewa, Wellington, New Zealand

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First record of Paintedhand Mudbug (*Lacunicambarus polychromatus*) in Ontario and Canada and the significance of iNaturalist in making new discoveries

COLIN D. JONES^{1,*}, MAEL G. GLON², KAREN CEDAR³, STEVEN M. PAIERO⁴, PAUL D. PRATT³, and THOMAS J. PRENEY³

¹Natural Heritage Information Centre, Ontario Ministry of Natural Resources and Forestry, Science and Research Branch, Peterborough, Ontario, Canada

'First Known Photographs of Living Specimens': the power of iNaturalist for recording rare tropical butterflies

Thomas Mesaglio¹ · Aaron Soh² · Steven Kurniawidjaja³ · Chuck Sexton⁴

Received: 16 April 2021 / Accepted: 17 September 2021 / Published online: 23 September 2021

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Policy

Frequency and type of citizen science use in policy documents.



Summarize the Use of Citizen Science

Peer-reviewed
literature

Environmental
Impact
Statements

Paper Search

- Collaborative effort of 14 researchers from around the world
- We searched for peer-reviewed literature using the term “iNaturalist” on Web of Science, Scopus, Science Direct, and Google Scholar
 - Google Scholar searched the entire article for the term “iNaturalist” not just title or abstract



ELSEVIER
Scopus
ScienceDirect

Google Scholar

 **Clarivate**
Web of Science™

Inclusion Criteria



Written in English or Spanish



The paper uses iNaturalist data or deeply discusses the platform



Peer-reviewed, scientific article



Accessible using institutional credentials and electronically available

Literature Review

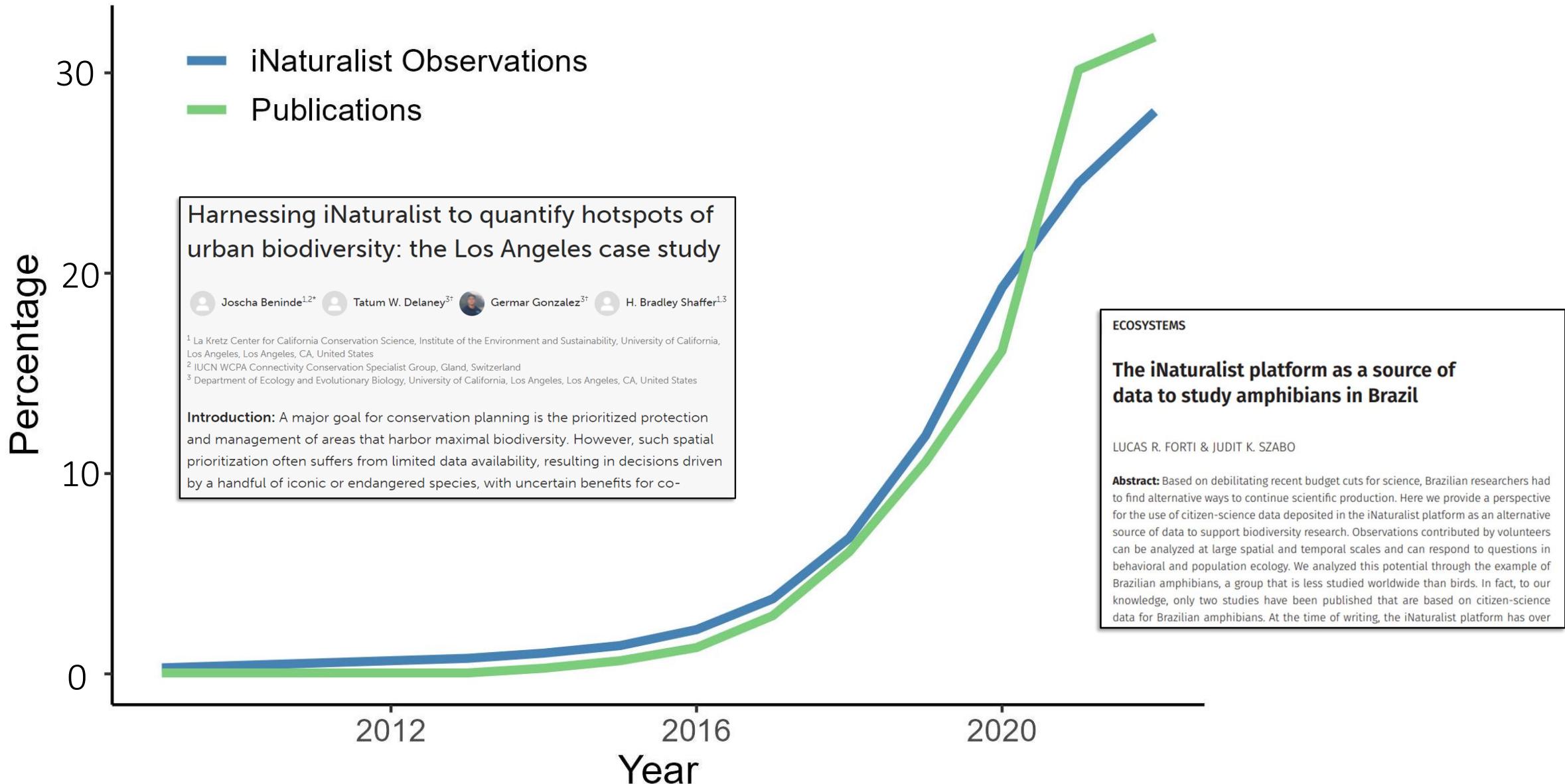
Results

Our search produced 11,002 articles, of which 2,560 met our search criteria

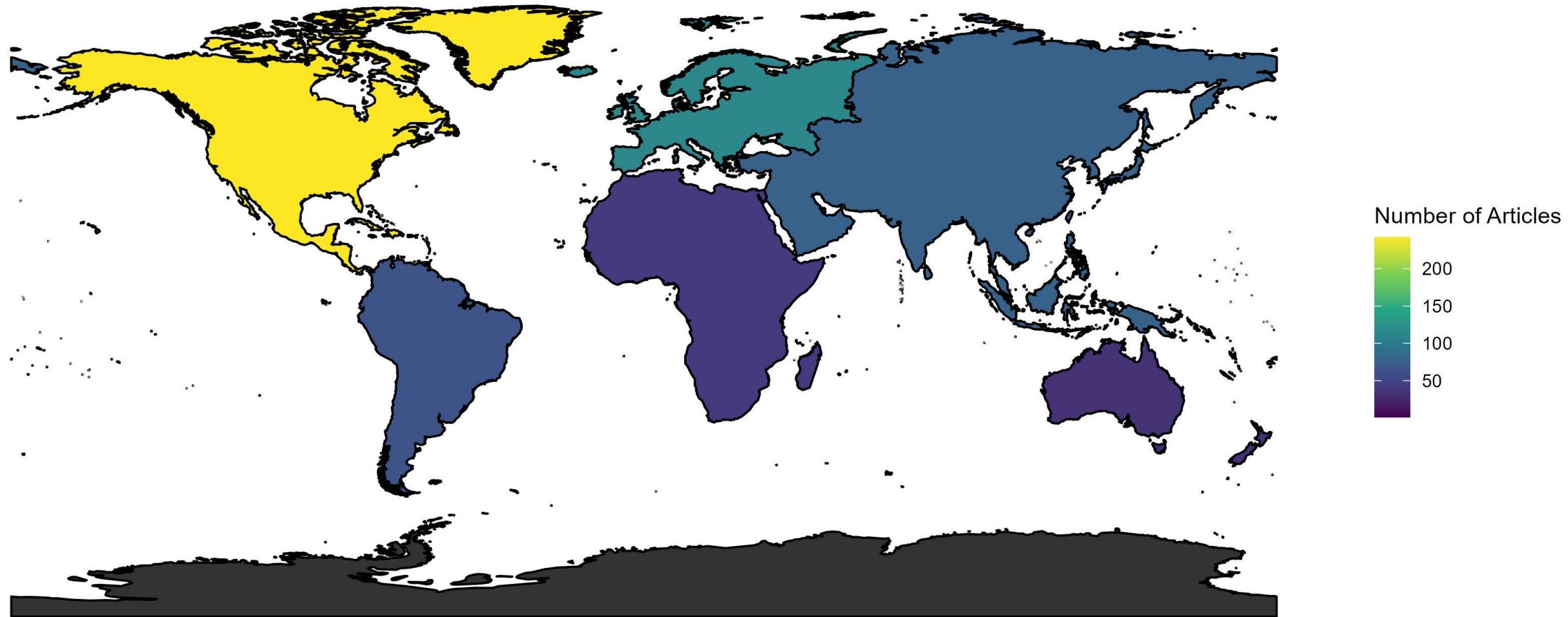
Here we present preliminary analysis results on 645 articles that have been tagged



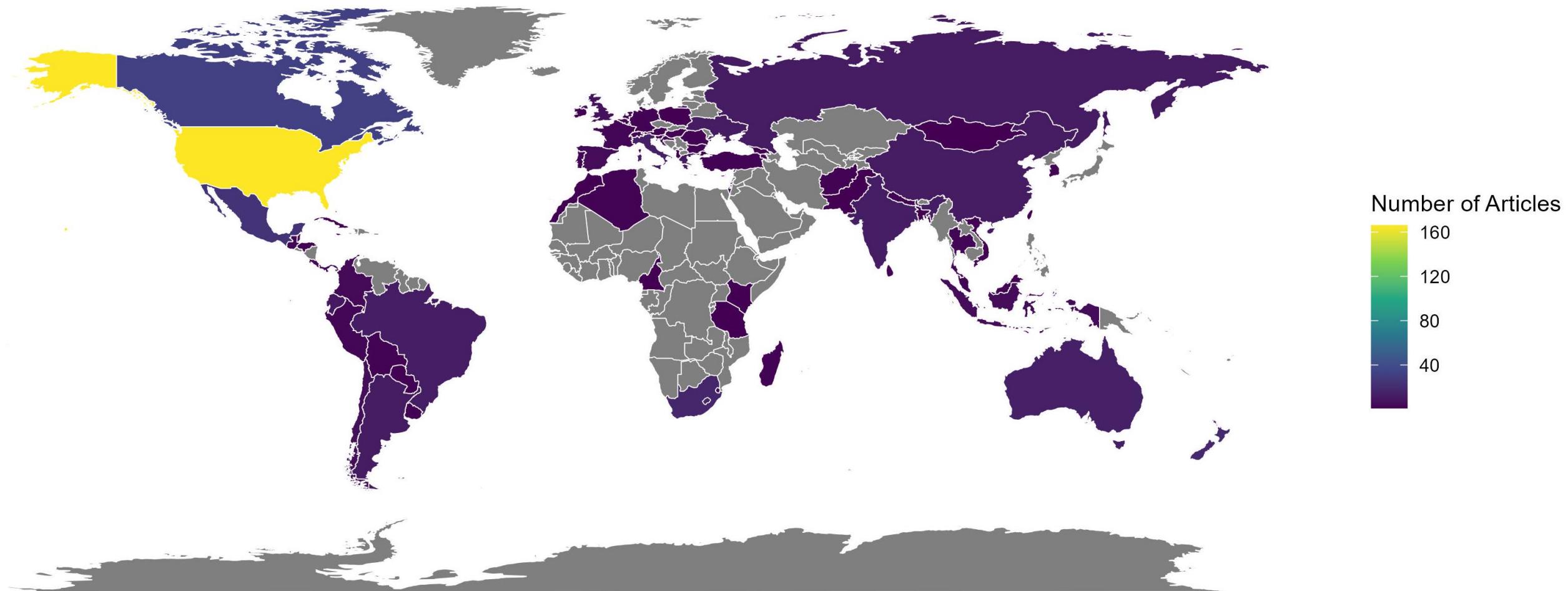
Increasing number of articles that mention iNaturalist!



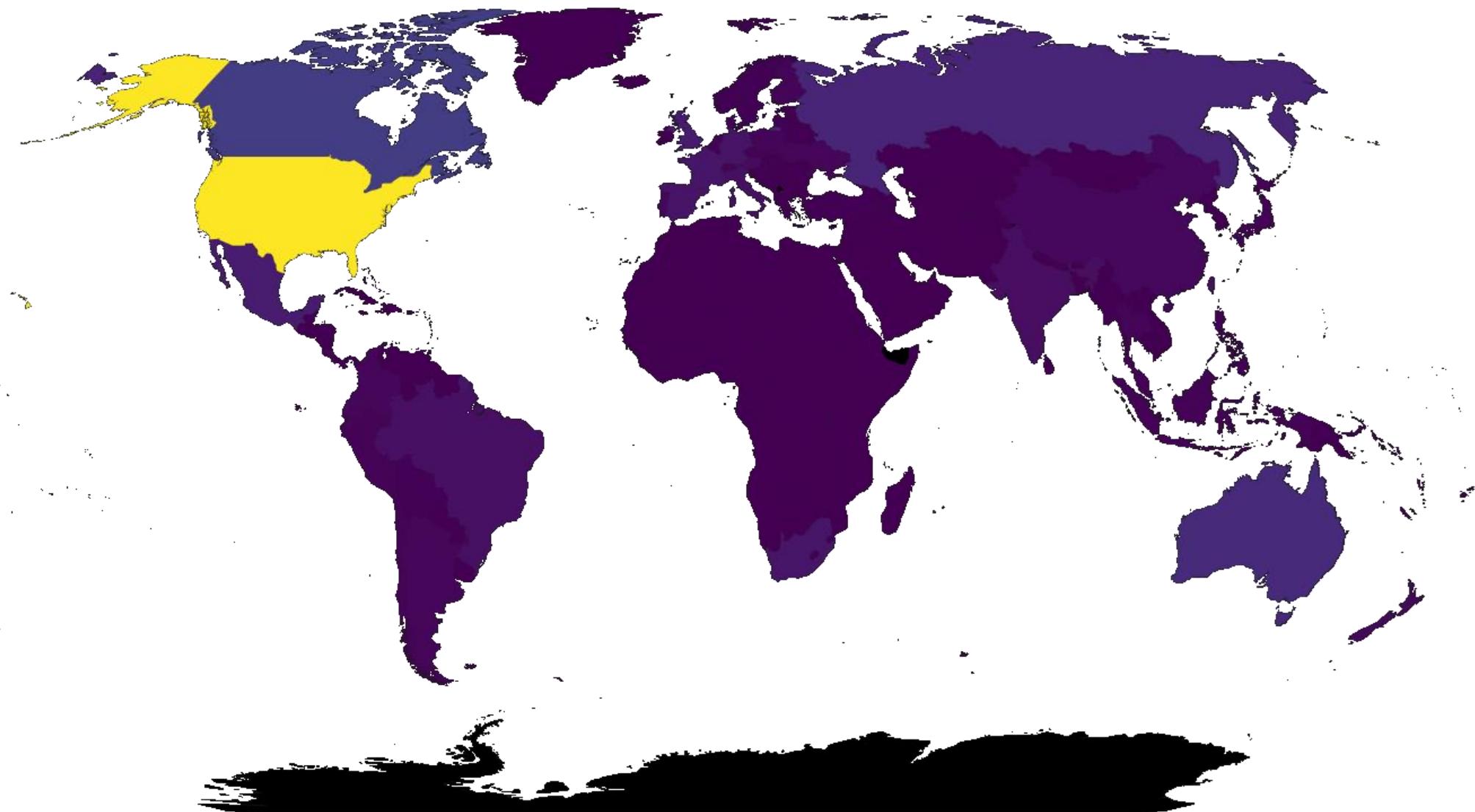
Study area of articles using iNaturalist data



Study area of articles using iNaturalist data



iNaturalist observations by country in 2023



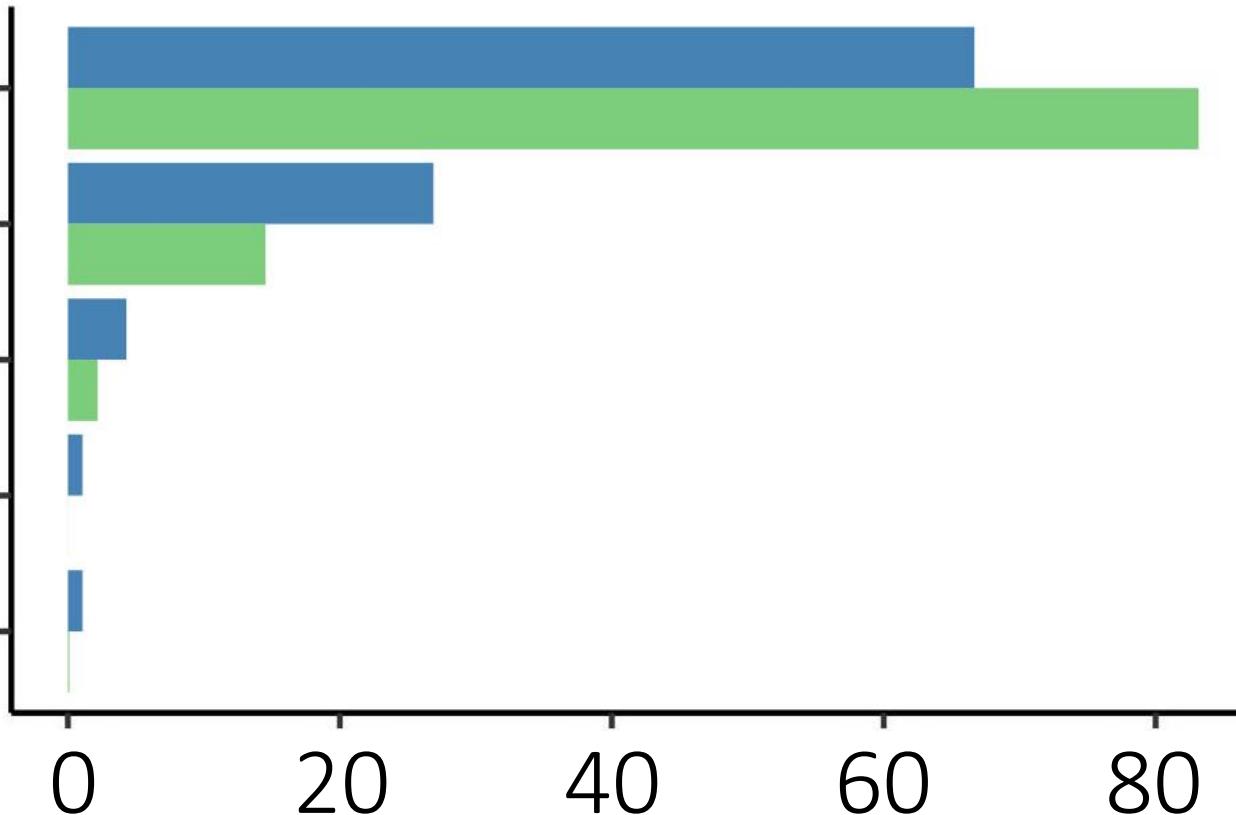
Study taxon of articles that use iNaturalist data

c)

Plantae

Class

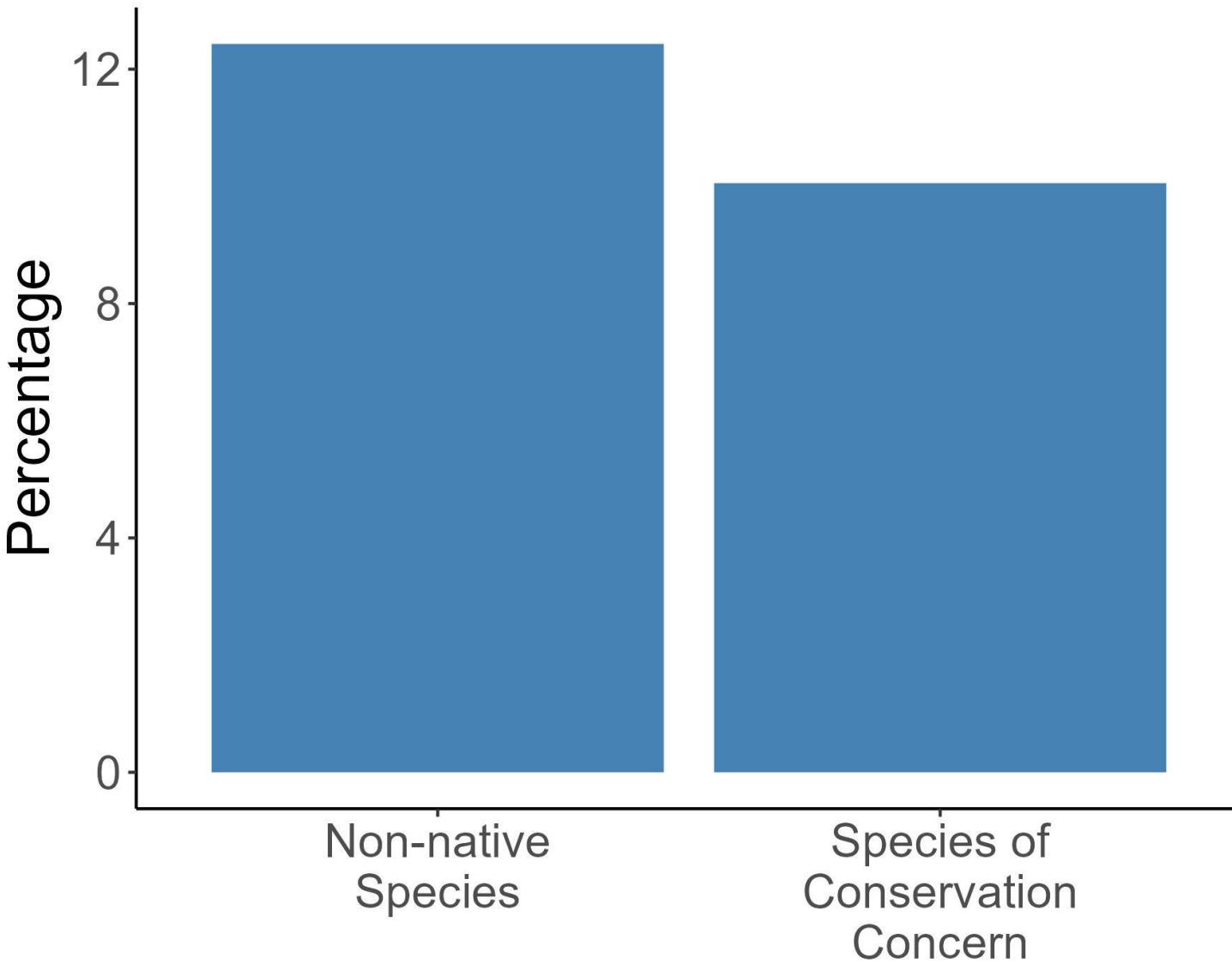
Magnoliopsida
Liliopsida
Pinopsida
Charophyceae
Marchantiopsida



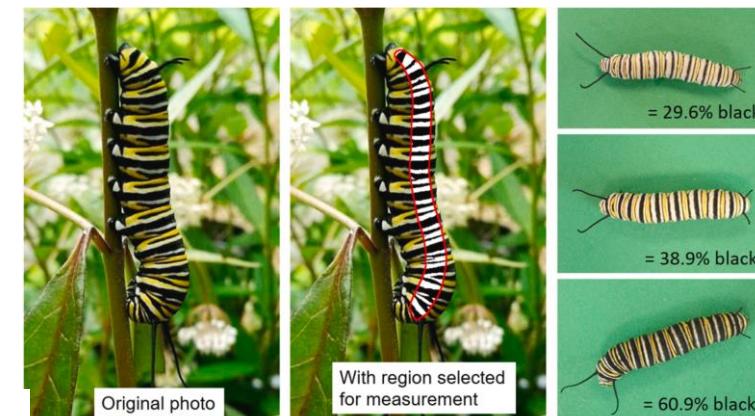
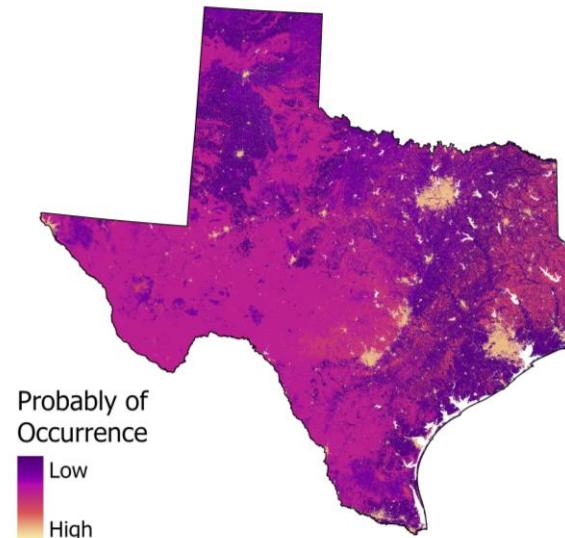
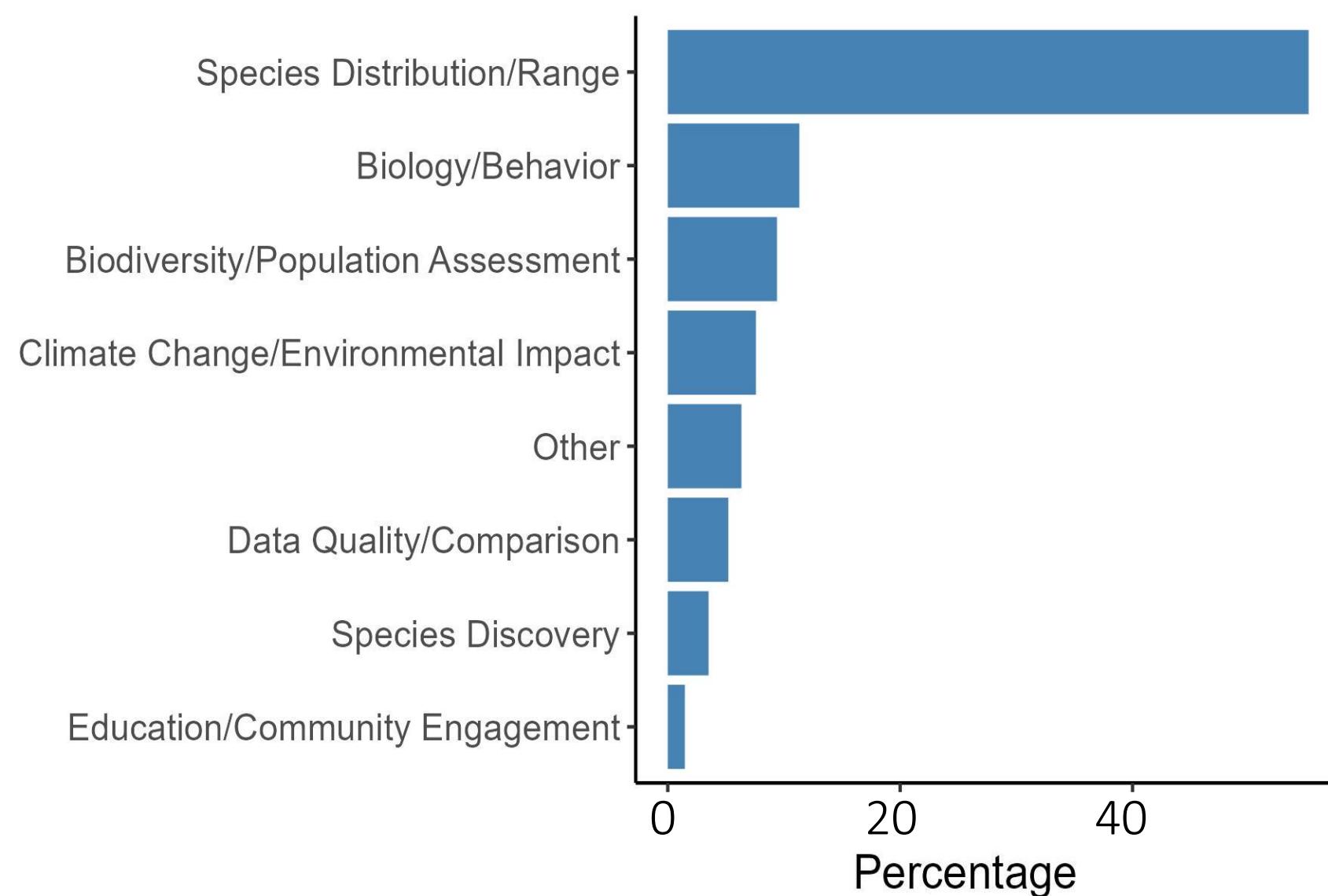
Number of Articles
iNaturalist Observations



Species Status

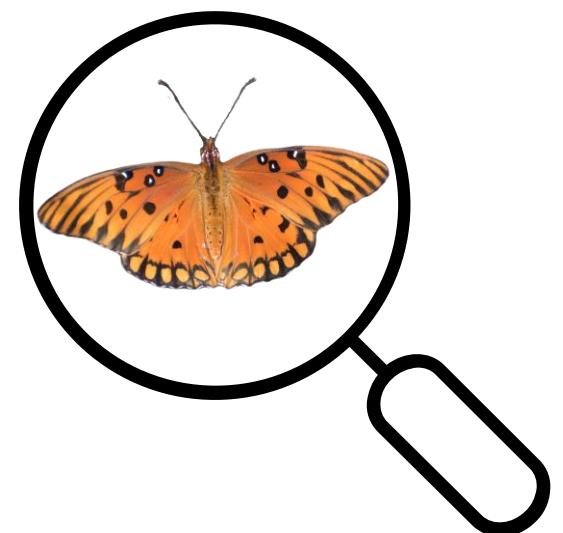
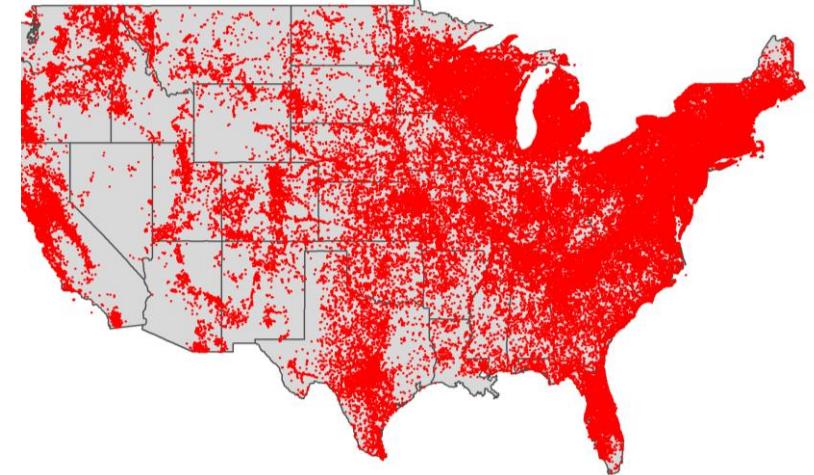
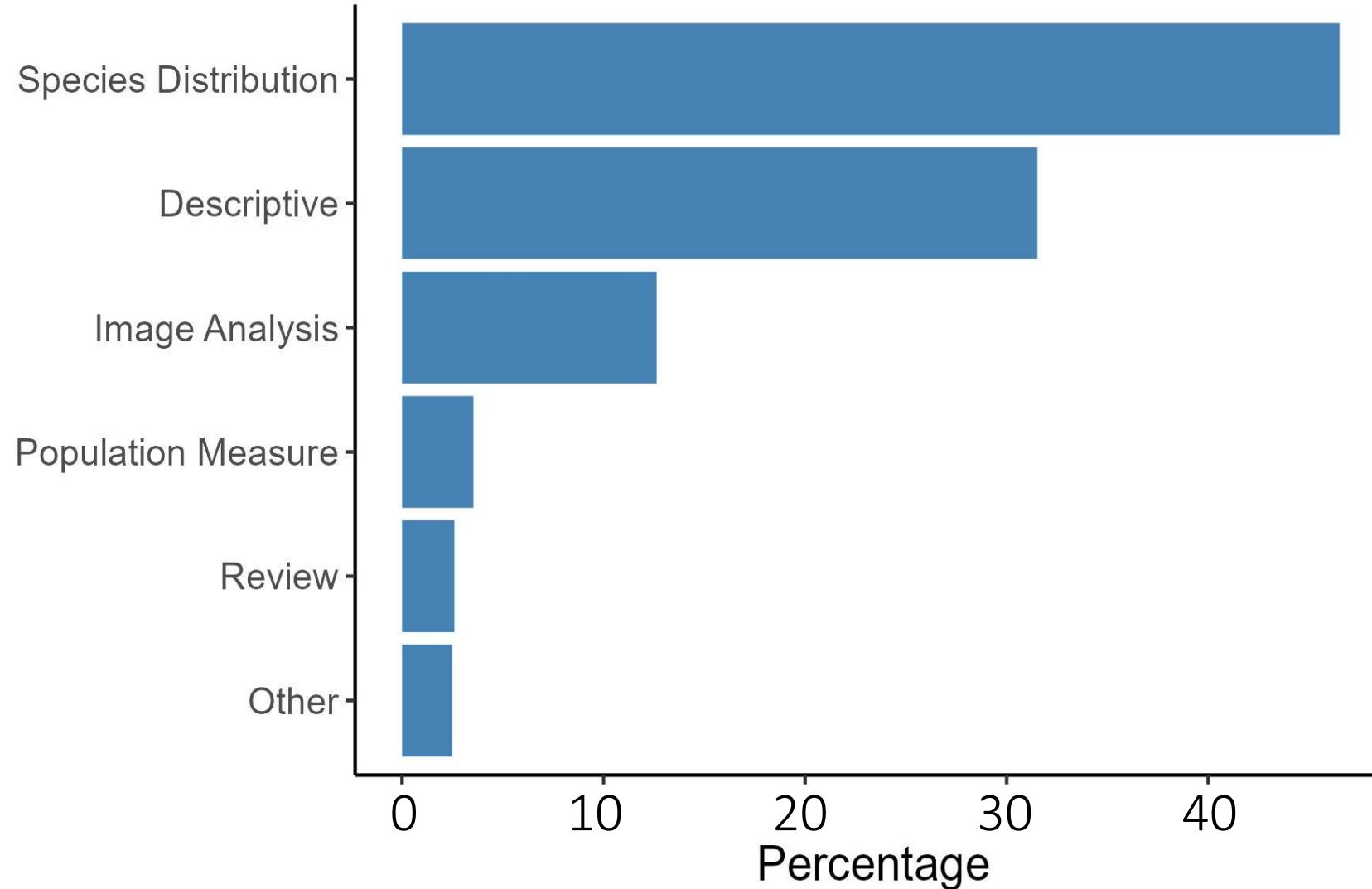


Count of topics addressed using iNaturalist data

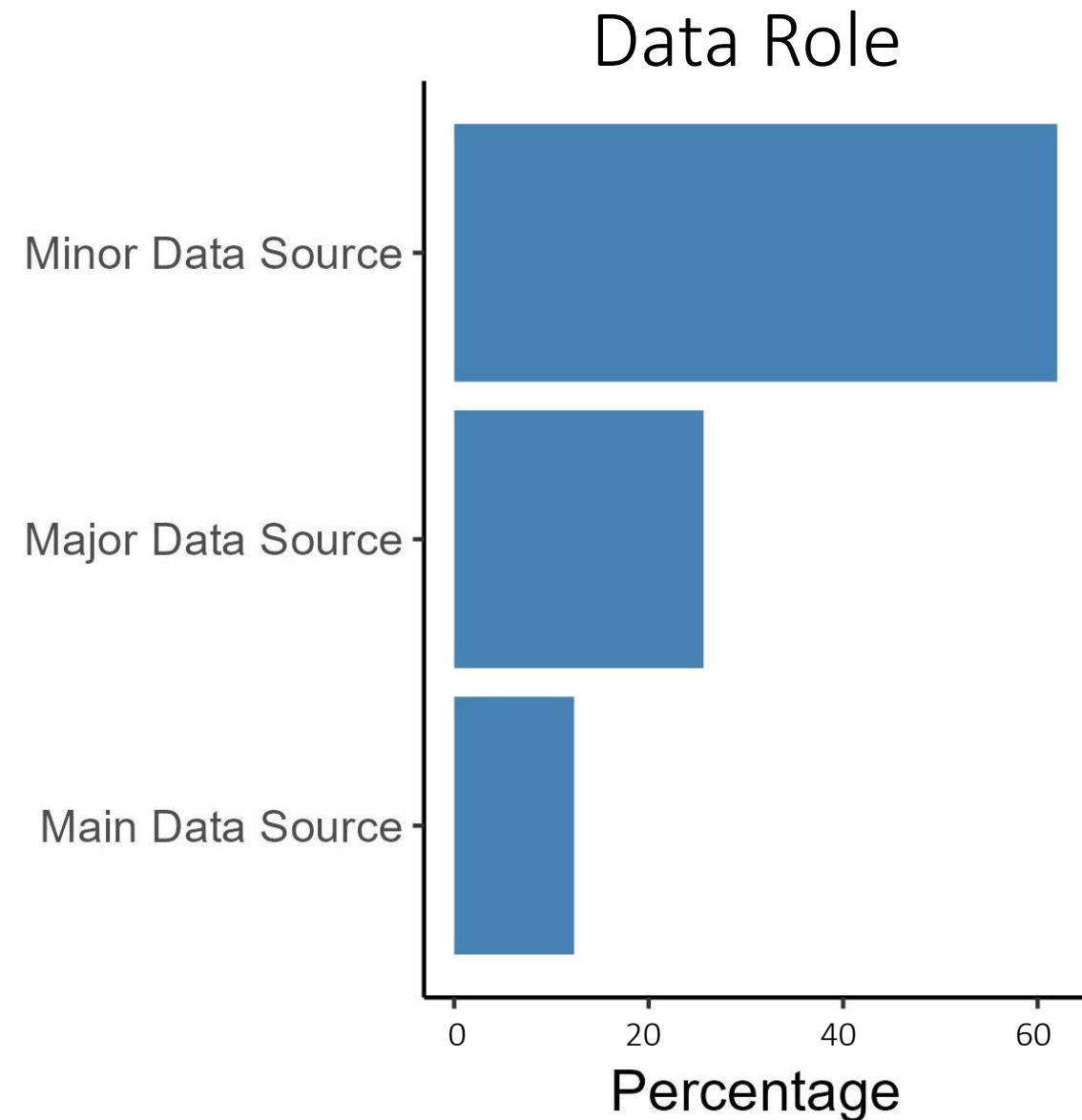
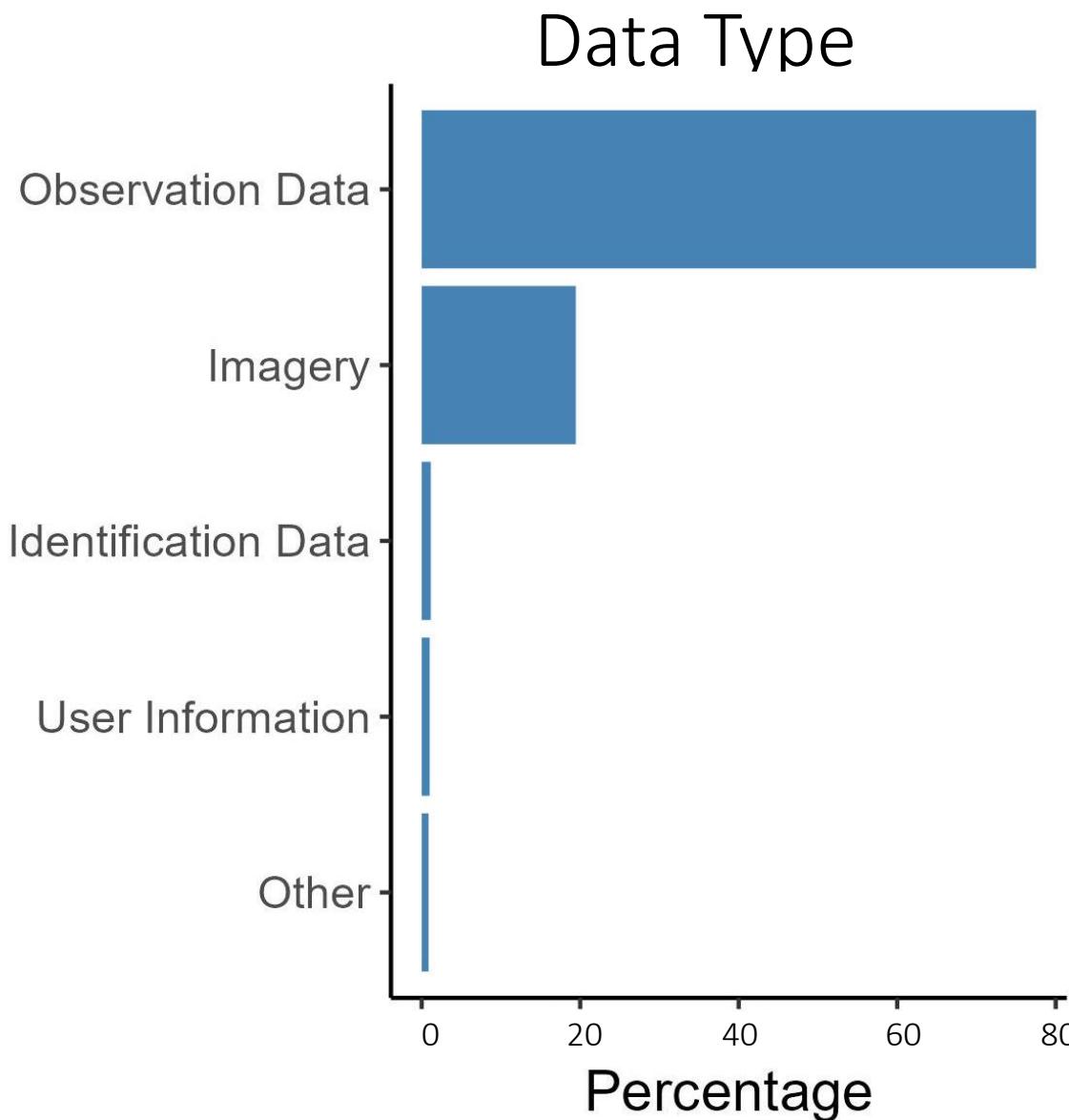


Davis, A. K., Nibbelink, N., & Deneka, C. J. (2022). Revisiting geographic variation in melanism of monarch butterfly larvae in North America using iNaturalist photos. *Journal of Thermal Biology*, 110, 103374.

Count of analyses used on iNaturalist data



iNaturalist data types and their role in the literature



Summarize the Use of Citizen Science

Peer-reviewed
literature

Environmental
Impact
Statements

Citizen science as a valuable tool for environmental review

Corey T. Callaghan^{1,*}, Carly Winnebald², Blaze Smith², Brittany M. Mason¹, Laura López-Hoffman²

¹Department of Wildlife Ecology and Conservation, Fort Lauderdale Research and Education Center, University of Florida, Davie, FL 33314-7719

²School of Natural Resources and Environment and Udall Center for Studies in Public Policy, University of Arizona, 803 East First Street, Tucson, AZ 85719 USA

*Corresponding author. email: c.callaghan@ufl.edu

United States National Environmental Policy Act (NEPA)



Involves science and the public in federal decision-making



Requires environmental review of potential impacts of proposed federal action



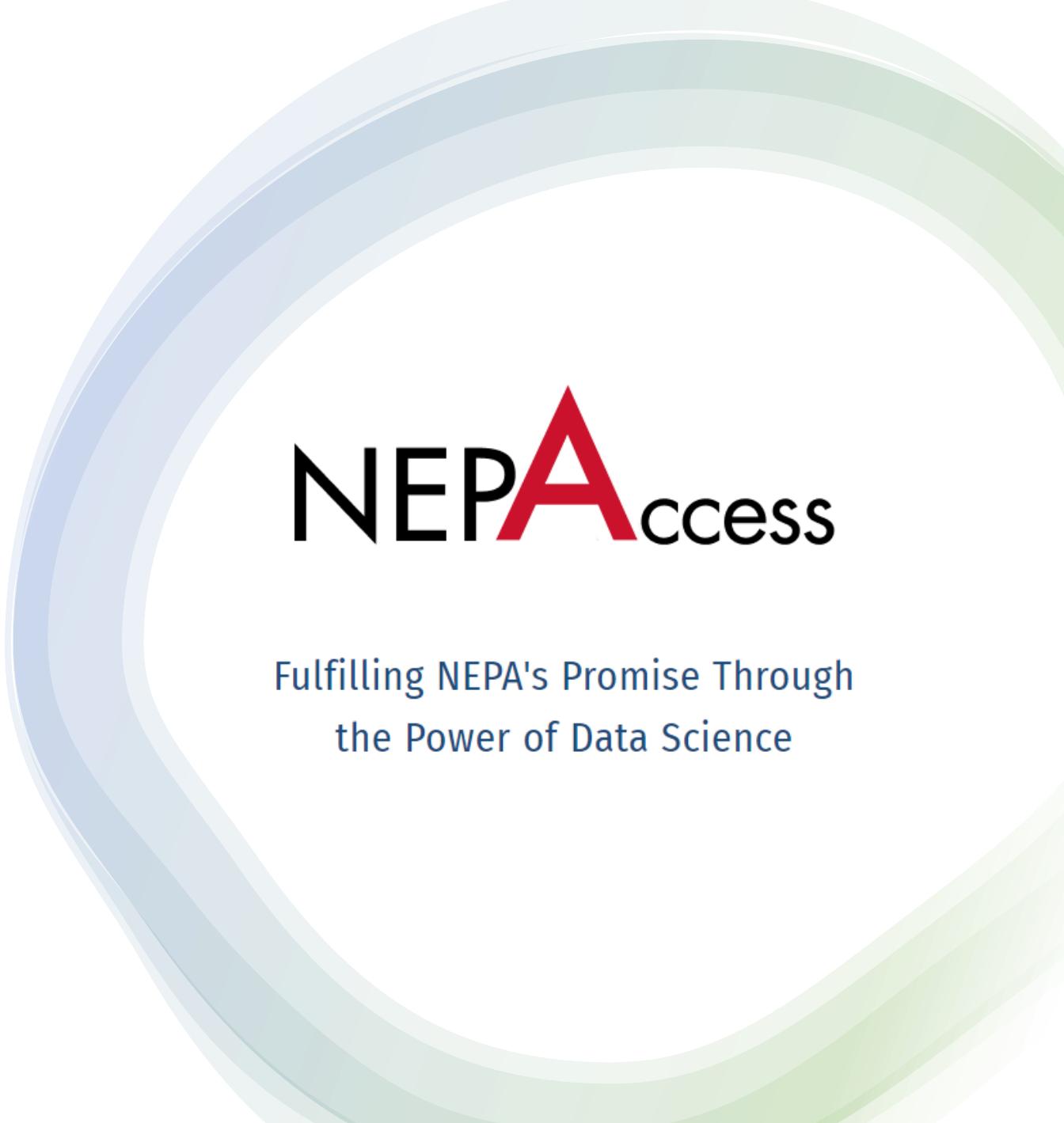
There are three levels of analysis under NEPA – Environmental Impact Statements (EIS), Environmental Assessment, and Categorical Exclusion

Environmental Impact Statement Search

We searched the NEPAcces database for EISs completed between 2012-2022 that contain the following keywords:

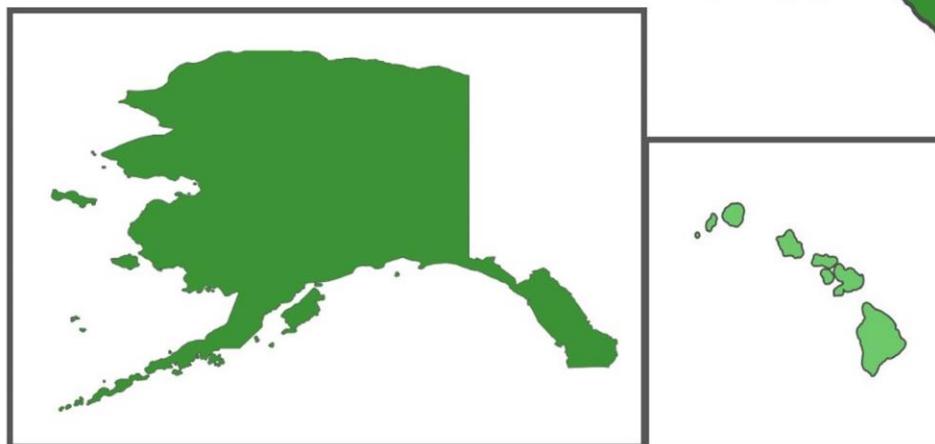
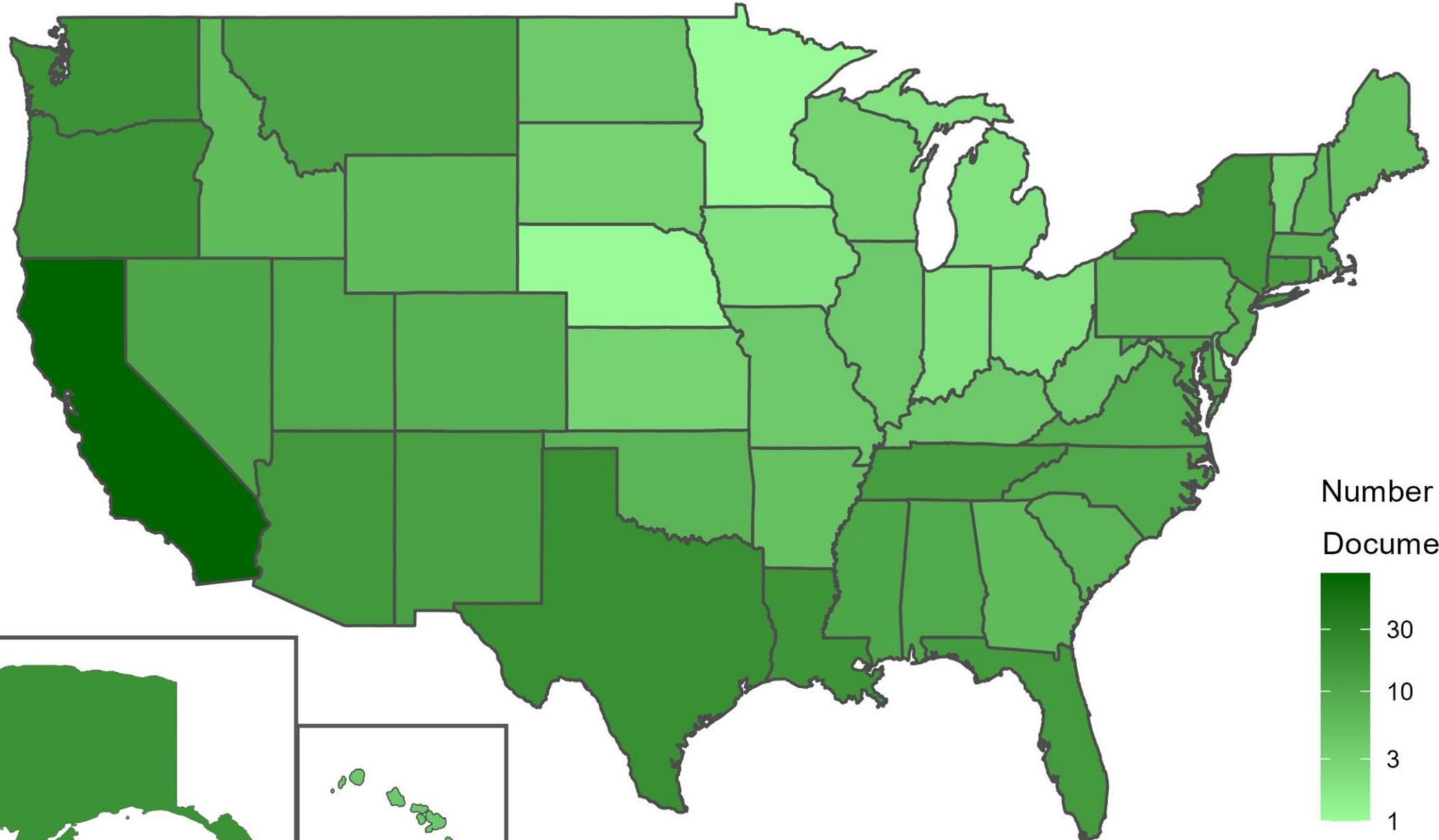
- Citizen science
- Community science
- eBird
- iNaturalist

We searched 1,355 EIS documents of which 228 were used in analysis

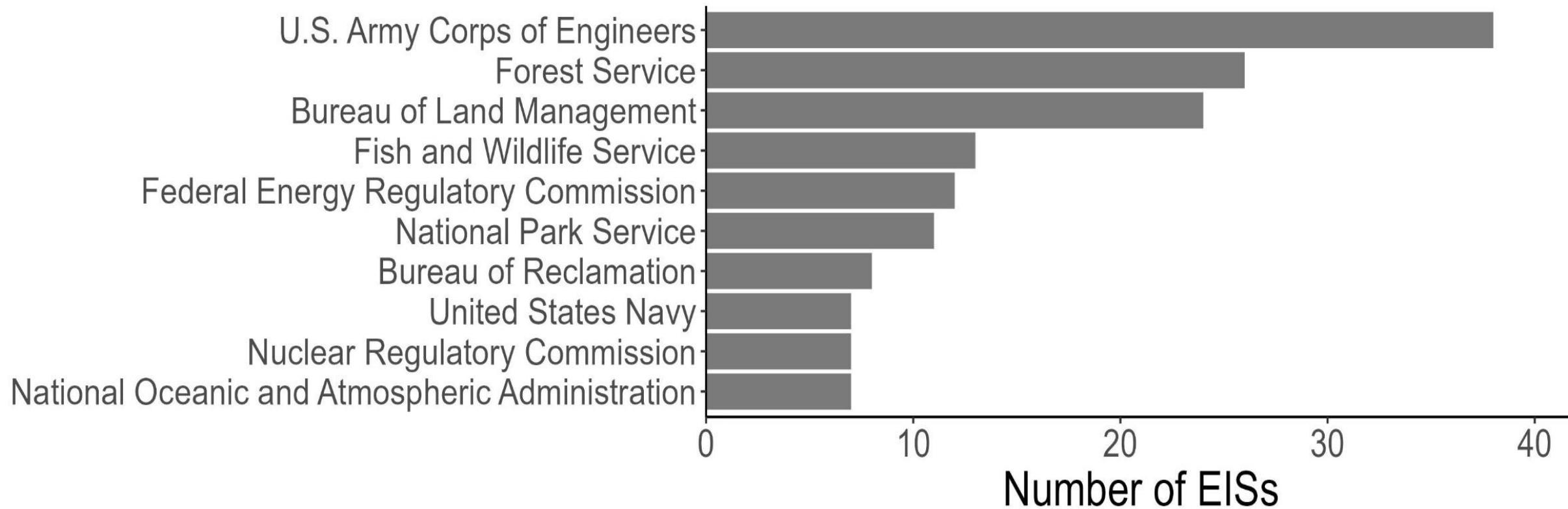
The logo for NEPAcces features the word "NEPA" in black and "Access" in red, with a large stylized "A" in red. This logo is positioned within a graphic consisting of three concentric circles. The innermost circle is light blue, the middle circle is white, and the outermost circle is light green.

NEPAcces

Fulfilling NEPA's Promise Through
the Power of Data Science



EISs using citizen science data were present across 45 agencies



Presence: “In eBird, there are 687 records of 969 [olive-sided flycatcher] individuals on the Inyo National Forest” (Forest Service 2019).

Absence: “No records of [Arkansas river shiner] have been submitted to iNaturalist (2021) from within or close to the landscape analysis area” (Rural Utilities Service 2022).

Definition: Citizen science methods were directly applied to identify species of interest in the EIS.

Definition: The use of citizen science methods in the EIS was unclear.

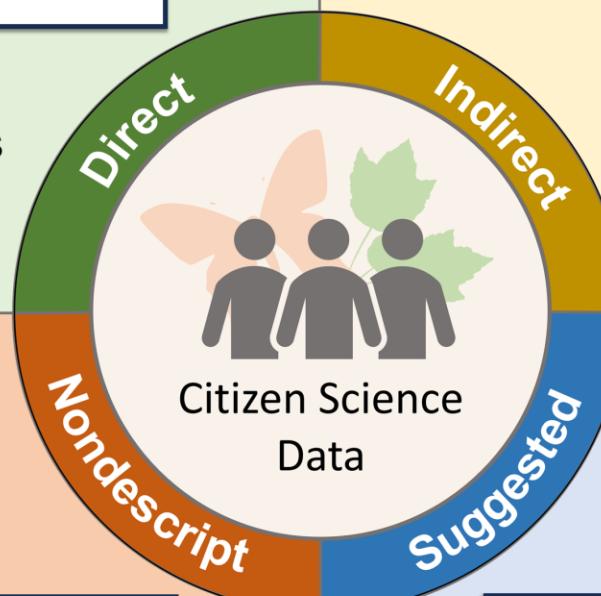
“Programs . . . offered . . . focus on historical/cultural resources (e.g., Carroll Homestead Tours) and natural resources (e.g., iNaturalist Walk)” (National Park Service 2019).

“[Rufa red knot] is generally restricted to ocean coasts during winter and occurs primarily along the coast during migration . . . (eBird 2019)” (DOS 2019).

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“The [National Bison Range] will use online, citizen science bird monitoring platform (eBird.org) for continued surveillance of occurrence” (Fish and Wildlife Service 2019).



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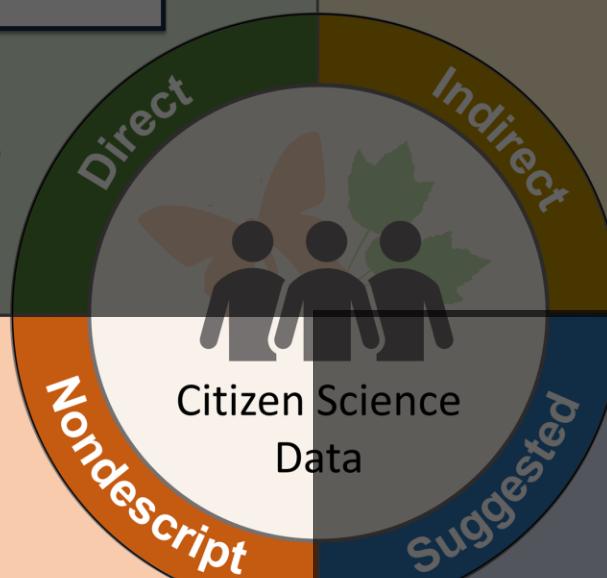
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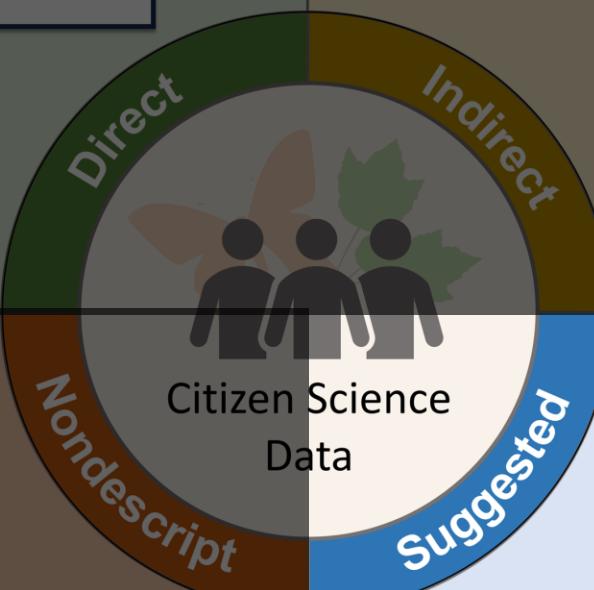
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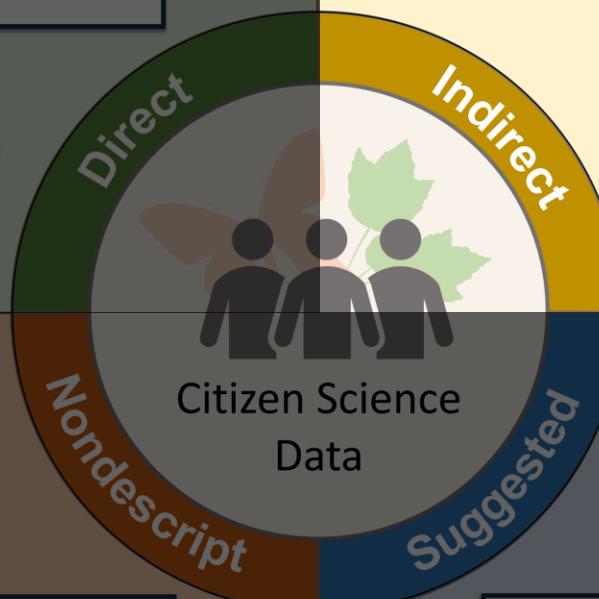
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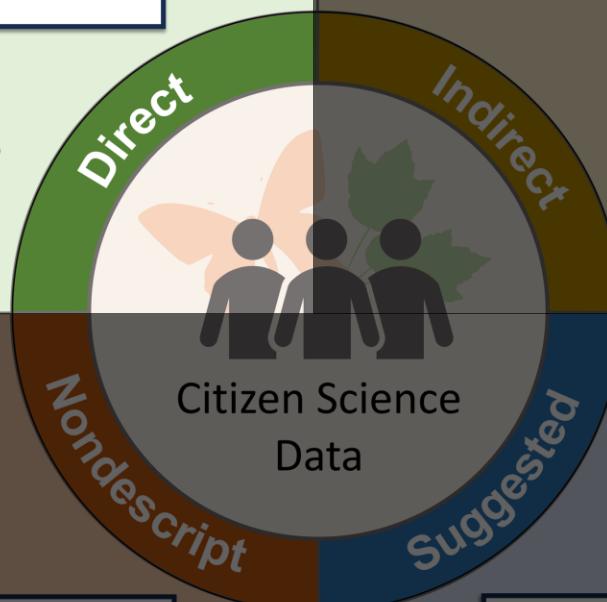
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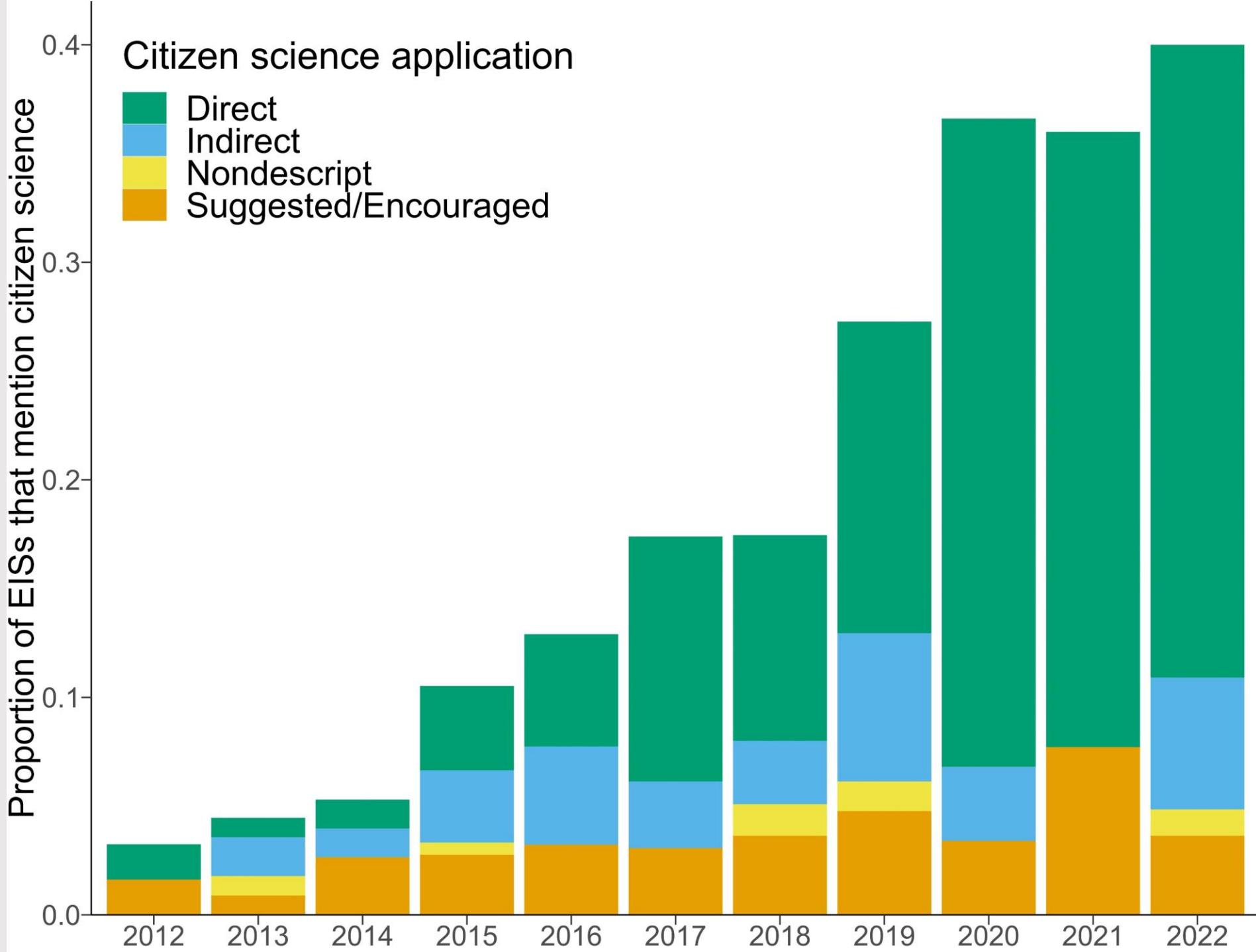
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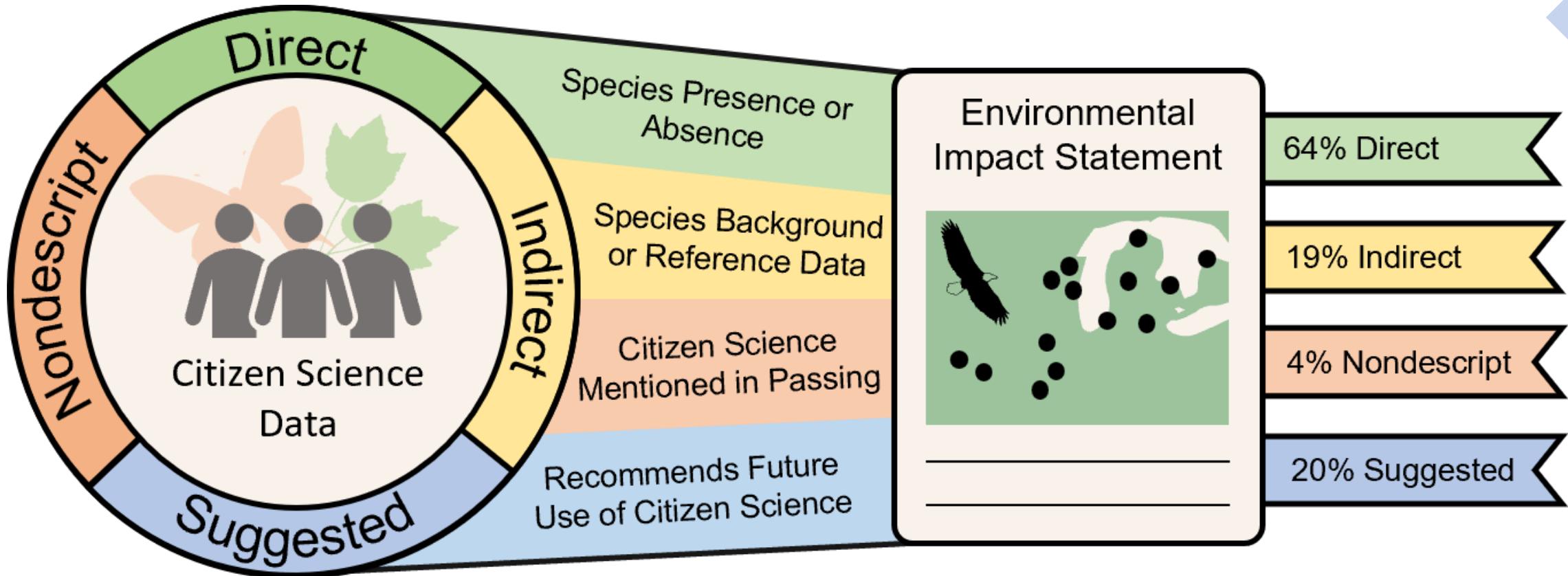
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Numbers



87% eBird

6% iNaturalist

Observations



Arkansas River Shiner
(*Notropis girardi*)

Nov '19



Arkansas River Shiner



1
OBSERVATION

1
SPECIES

The World

Map

Grid

List



Photo by: Ken Collins

12% of all EISs used no sighting of a species as evidence of absence of that species

- Worthy of future discussion
- Not clear how they accounted for sampling effort or the iNaturalist location buffer for threatened species

"No records of [Arkansas river shiner] have been submitted to iNaturalist (2021) from within or close to the landscape analysis area" (Rural Utilities Service 2022)

Future of Citizen Science in Environmental Review

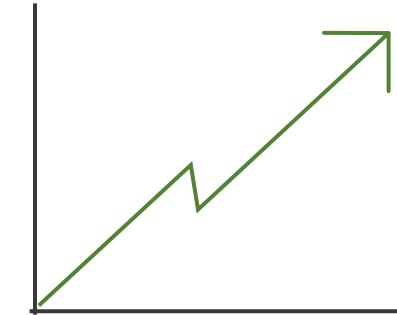
Our results show increasing use and future potential of citizen science in environmental review



Value of Citizen Science in Environmental Review



Agencies interacting with volunteers



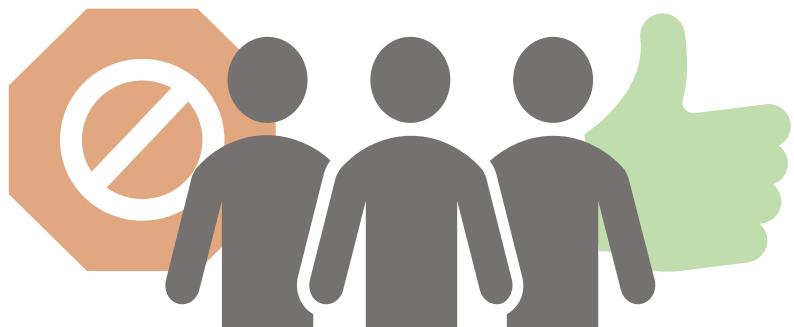
More Data



Increased public
engagement

Future of Citizen Science in Environmental Review

The future of citizen science use in environmental consulting is worthy of further discussion



Consider the extent that citizen science participants are willing to share data



- Nuanced understanding of the data
- Appropriate statistical analyses

Ensure conclusions are scientifically sound

Policy

Citizen Science is becoming more commonly used!



Citizen science involves the public in the EISs process



Citizen science increases data that can be used for EISs



Questions

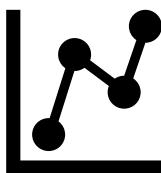
Are citizen scientists willing to share their data for EISs?

How can we ensure conclusions made on citizen science data are scientifically sound?

Research



Citizen science contributes to important scientific research (2,560 articles and growing!)



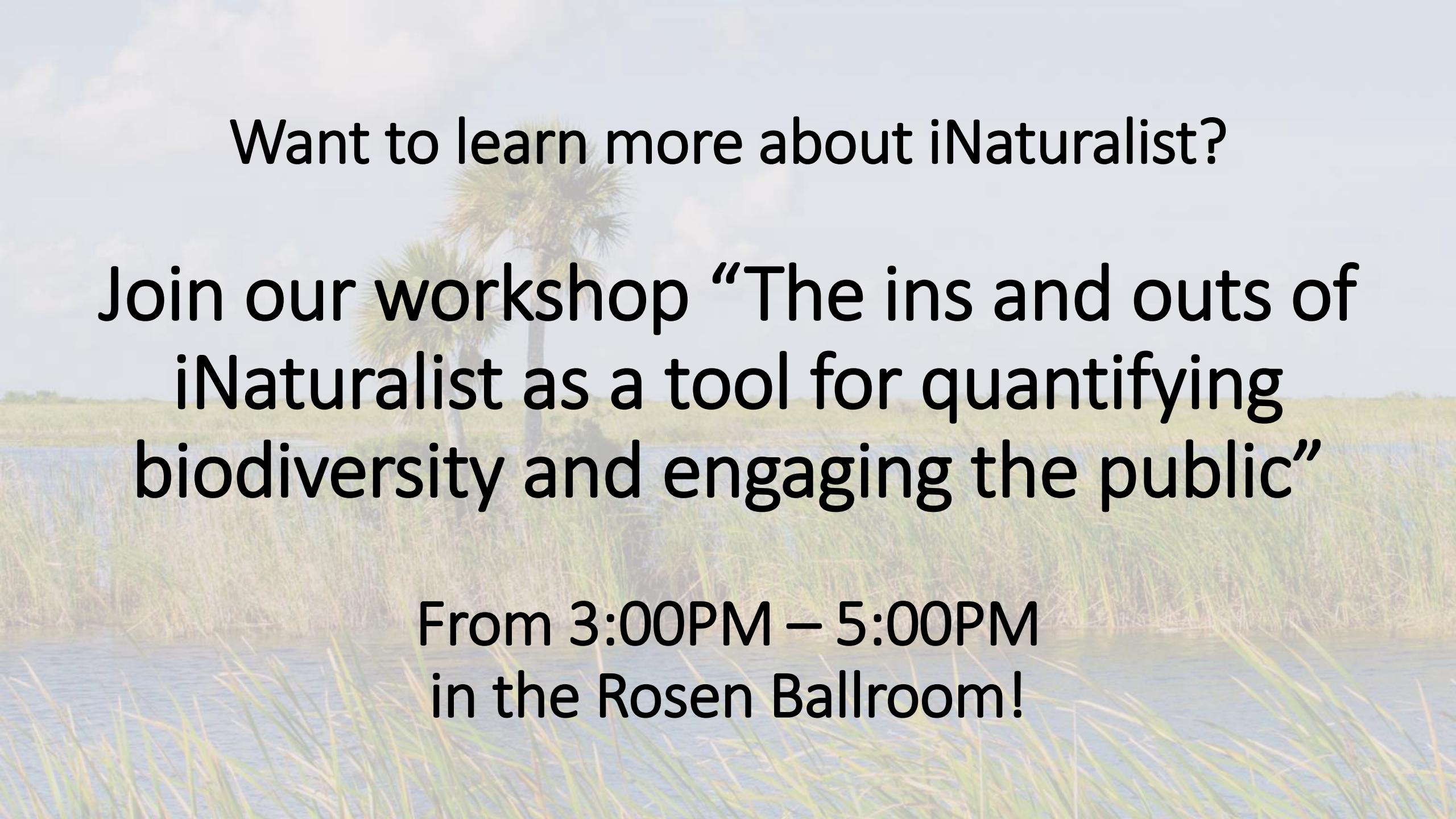
Similar trends between articles that use iNaturalist and iNaturalist observations



Many uses of citizen science data with the most popular being species ranges



Citizen science often supplements professionally collected data or other data



Want to learn more about iNaturalist?

Join our workshop “The ins and outs of iNaturalist as a tool for quantifying biodiversity and engaging the public”

From 3:00PM – 5:00PM
in the Rosen Ballroom!



Thank you!



Brittany Mason
Data Management Analyst, UF
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