Citizen science as an approach for valuation of biodiversity in Environmental Impact Statements

Brittany Mason, Carly Winnebald, Blaze Smith, Laura López-Hoffman, and Corey T. Callaghan

UF IFAS
UNIVERSITY of FLORIDA

Global Ecology Research Group

Biodiversity and Ecosystem Services

Clean drinking water

Food

Clean air

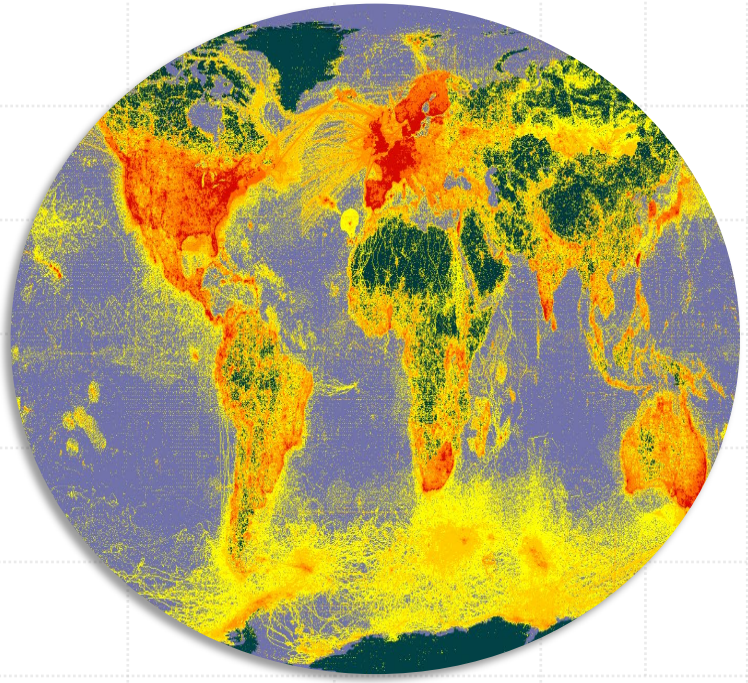
Aesthetic benefit

What is Citizen Science?

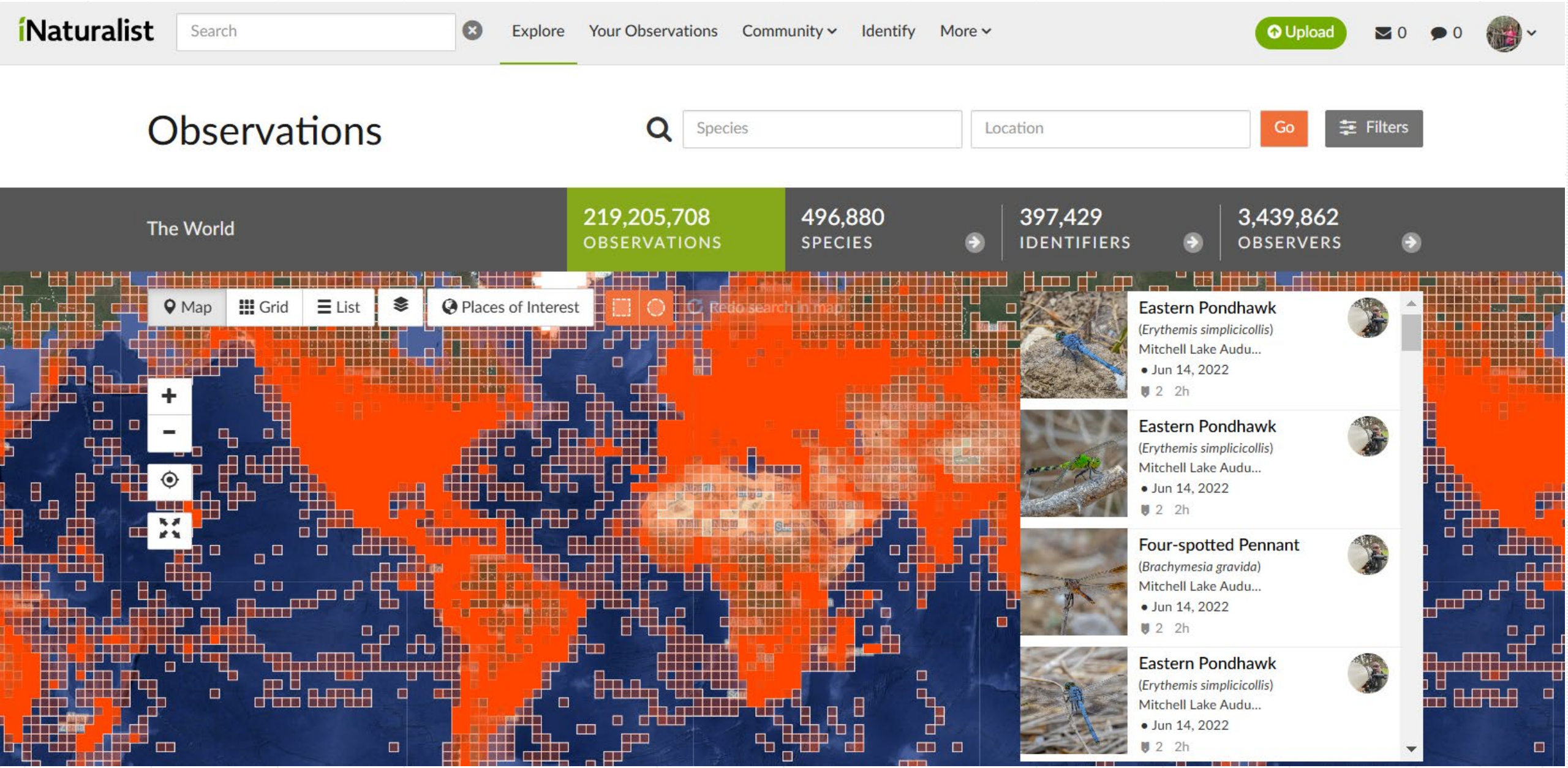
- Also commonly referred to as participatory science or community science
- Involves public engagement, education, and data collection
- Citizen science programs are interdisciplinary and result in scientific advancement

GBIF
Global Biodiversity Information Facility

eBird



Jordan et al. 2015. Citizen science as a distinct field of inquiry


iNaturalist
Search
Explore
Your Observations
Community
Identify
More
Upload
0
0
Observations
Species
Location
Go
Filters
The World
219,205,708
OBSERVATIONS
496,880
SPECIES
397,429
IDENTIFIERS
3,439,862
OBSERVERS
Map
Grid
List
Places of Interest
Redo search in map
Eastern Pondhawk
(Erythemis simplicicollis)
Mitchell Lake Audu...
Jun 14, 2022
2 2h
Eastern Pondhawk
(Erythemis simplicicollis)
Mitchell Lake Audu...
Jun 14, 2022
2 2h
Four-spotted Pennant
(Brachymesia gravida)
Mitchell Lake Audu...
Jun 14, 2022
2 2h
Eastern Pondhawk
(Erythemis simplicicollis)
Mitchell Lake Audu...
Jun 14, 2022
2 2h

Change Region

Florida

United States

Map

566 Species | 3.22M Checklists | 81,521 eBirders

My Stats 59 15 39 0

Overview

Bird List

Recent Checklists

Trip Reports

Subregions

Hotspots

eBirders

Illustrated Checklist

eBirding This Month

Nov 2024

Updated ~5 hours ago

348 Species | 17,751 Checklists | 3132 eBirders

Community Targets

American Black Duck

J F M A M J J A S O N D

Last observed by Anonymous eBirder on 2 Sep 2024

Eared Grebe

J F M A M J J A S O N D

Last observed by Hayden Epp on 11 Mar 2024

Common Goldeneye

J F M A M J J A S O N D

Last observed by Anonymous eBirder on 26 Mar 2024

New Species

Lapland Longspur

1 | 18 Nov 2024 | Rex Rowan

Old A1A beach at Summer Haven St. Johns

Eurasian Wigeon

1 | 18 Nov 2024 | Glenn Mitchell

Merritt Island NWR--Black Point Wildlife Drive Brevard

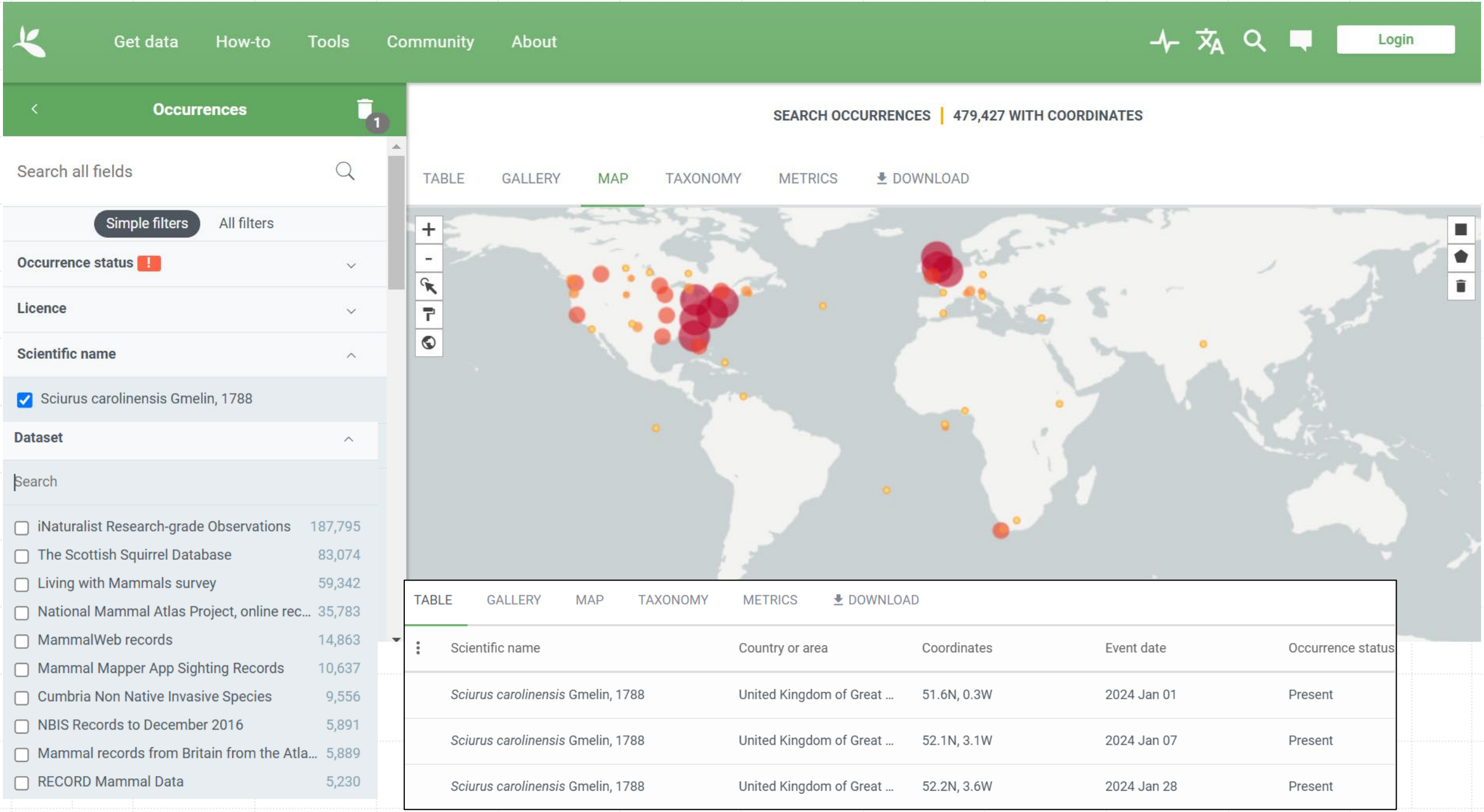
Calliope Hummingbird

1 | 17 Nov 2024 | Dalcio Dacol

Hummin' haven (private/restricted access) Alachua

Purple Martin

1 | 17 Nov 2024 | Don Morrow


Get data
How-to
Tools
Community
About
Login
Occurrences
1
Search all fields
Simple filters
All filters
Occurrence status
Licence
Scientific name
Sciurus carolinensis Gmelin, 1788
Dataset
Search
iNaturalist Research-grade Observations 187,795
The Scottish Squirrel Database 83,074
Living with Mammals survey 59,342
National Mammal Atlas Project, online rec... 35,783
MammalWeb records 14,863
Mammal Mapper App Sighting Records 10,637
Cumbria Non Native Invasive Species 9,556
NBIS Records to December 2016 5,891
Mammal records from Britain from the Atla... 5,889
RECORD Mammal Data 5,230
SEARCH OCCURRENCES | 479,427 WITH COORDINATES
TABLE
GALLERY
MAP
TAXONOMY
METRICS
DOWNLOAD
TABLE
GALLERY
MAP
TAXONOMY
METRICS
DOWNLOAD
Scientific name
Country or area
Coordinates
Event date
Occurrence status
Sciurus carolinensis Gmelin, 1788
United Kingdom of Great ...
51.6N, 0.3W
2024 Jan 01
Present
Sciurus carolinensis Gmelin, 1788
United Kingdom of Great ...
52.1N, 3.1W
2024 Jan 07
Present
Sciurus carolinensis Gmelin, 1788
United Kingdom of Great ...
52.2N, 3.6W
2024 Jan 28
Present


How is the data being used?

Citizen Science in Research

Literature Search

iNaturalist

Google Scholar

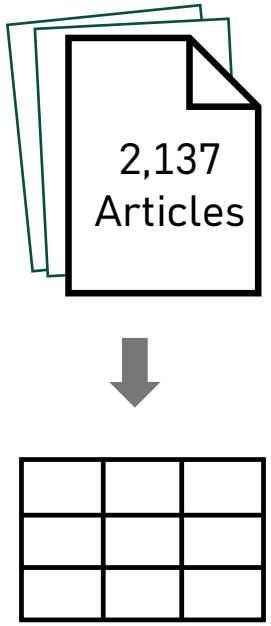
Scopus

Web of Science™

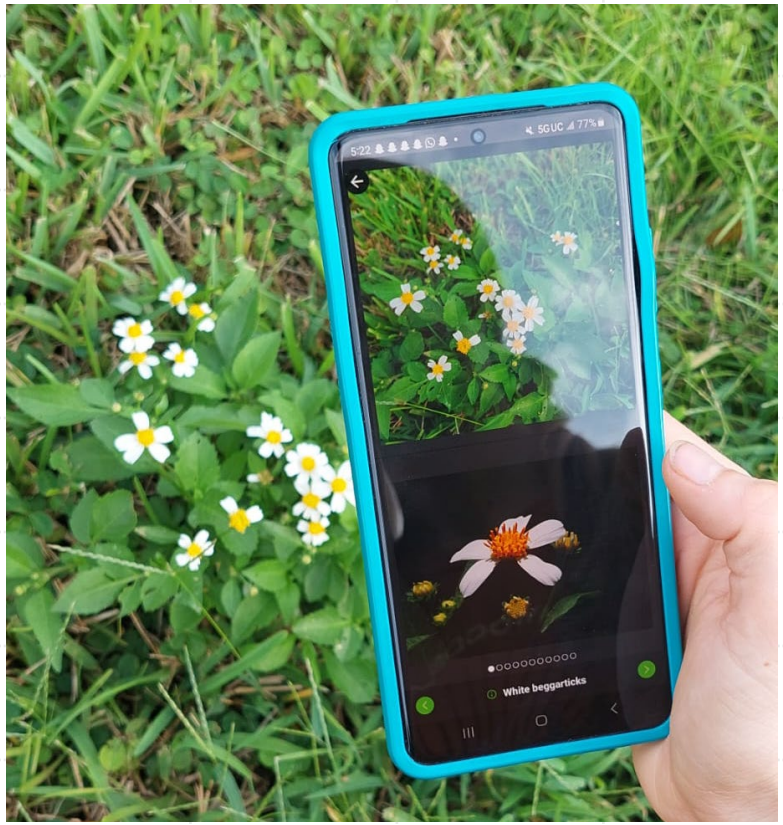
Screened articles for:

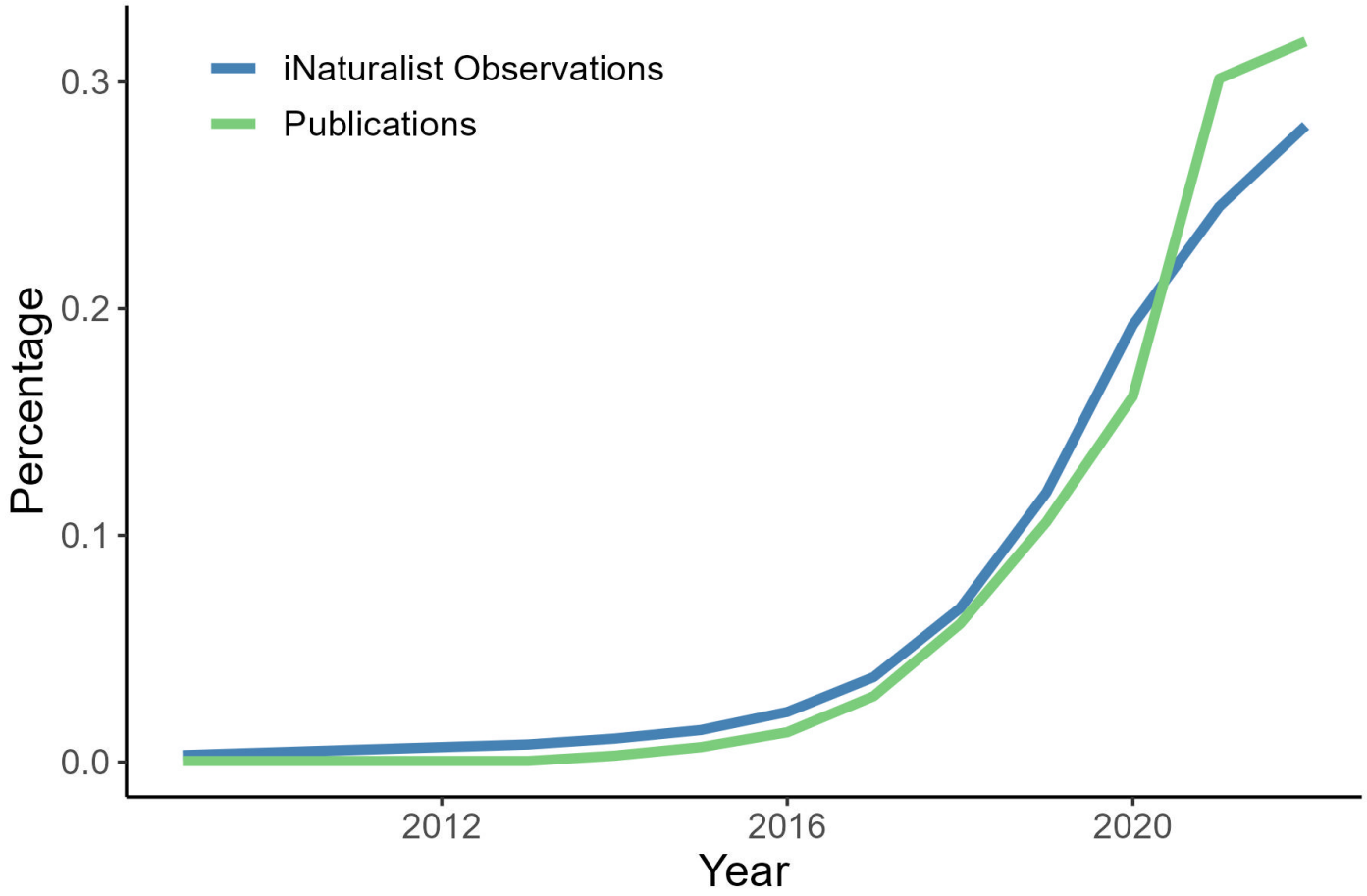
- Peer-review
- Electronically available
- Written in English or Spanish
- Used iNaturalist data or review of iNaturalist

Tag articles



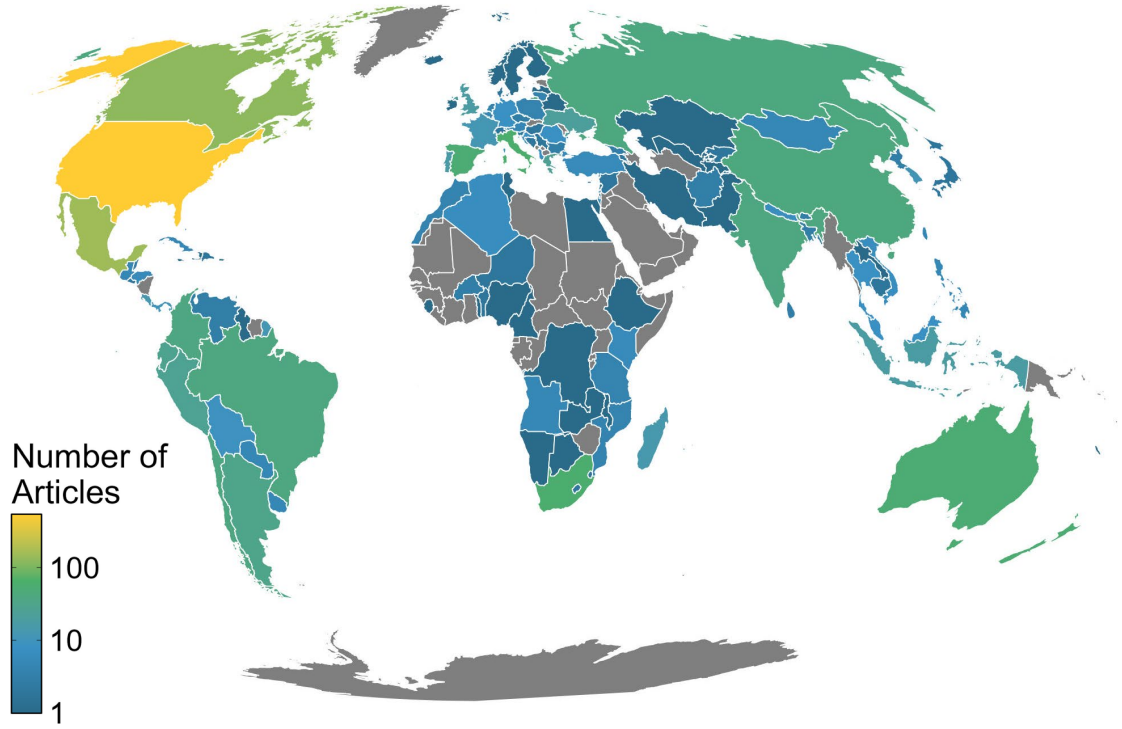
The use of iNaturalist data in scientific literature has grown significantly, paralleling the rapid increase in data availability from the platform.



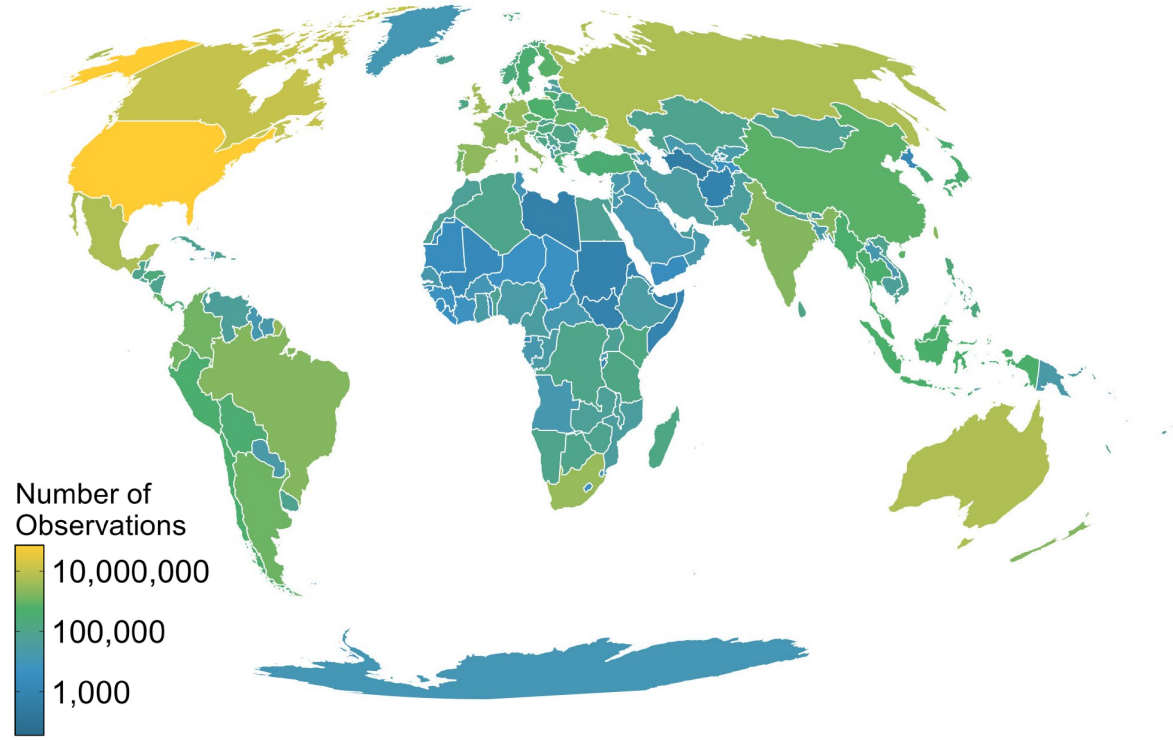


Global Distribution

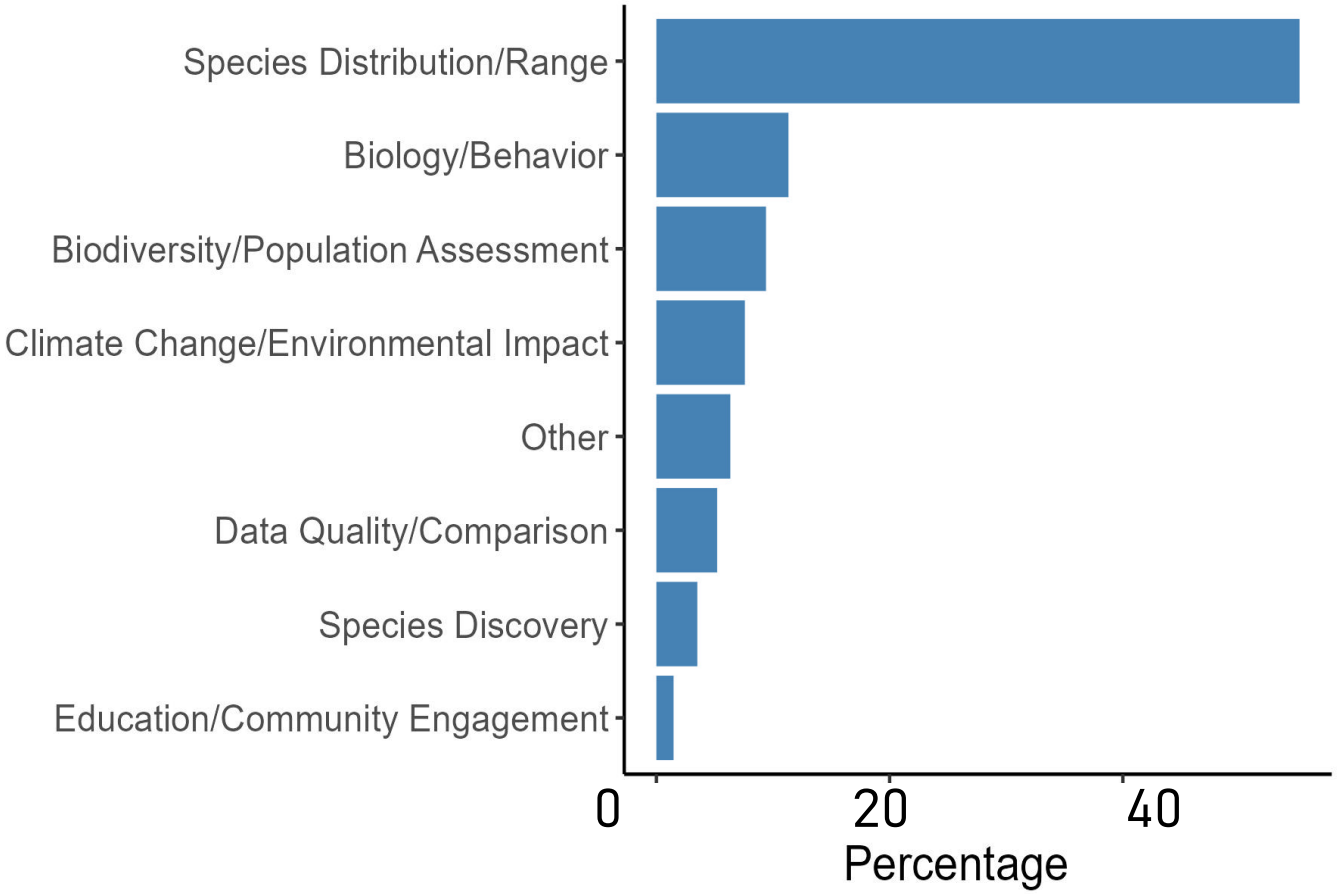
iNaturalist literature



iNaturalist observations

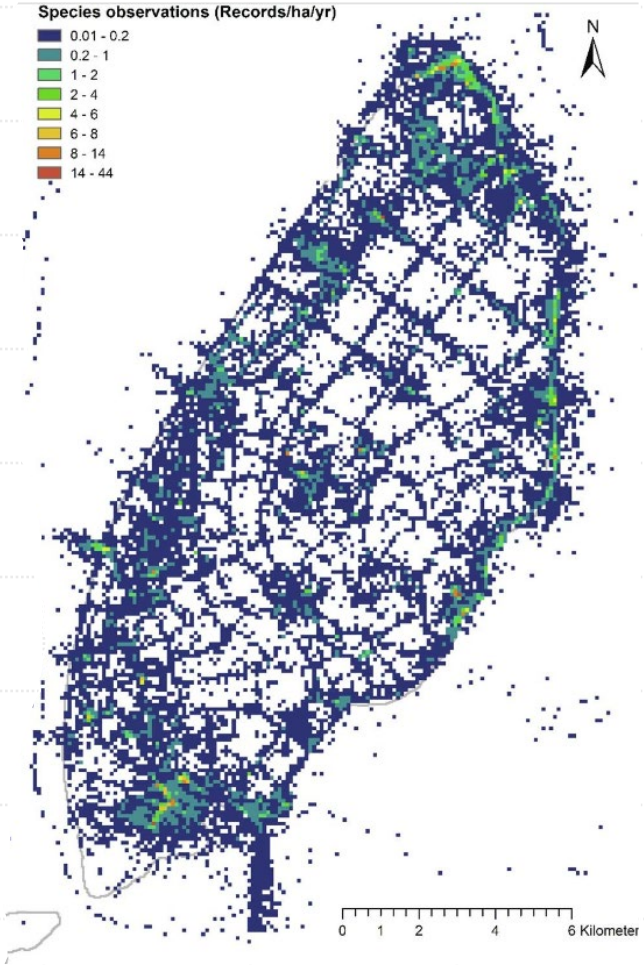


Range of topics



Citizen Science to Study Ecosystem Services

Map cultural ecosystem services



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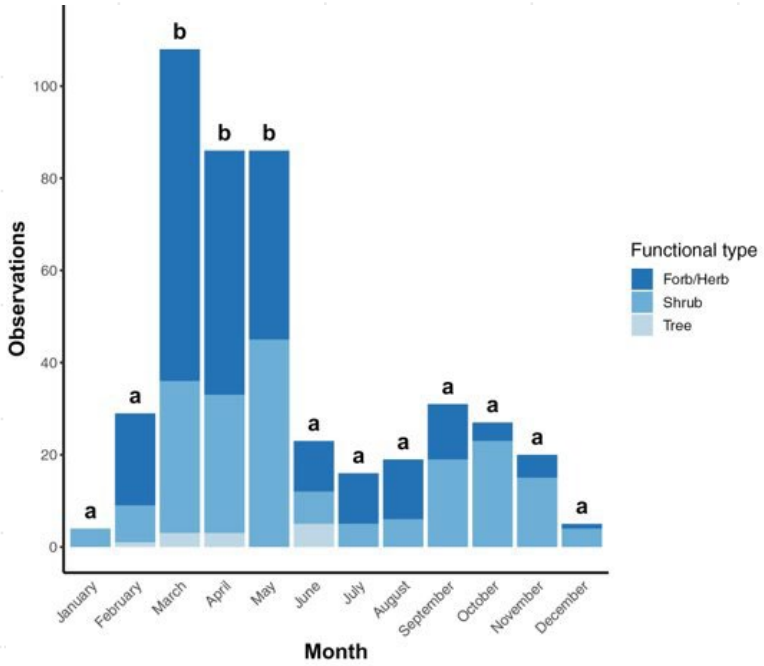
Determine plants visited by painted lady butterflies



Saldivar, J. L. A., Romero, A. N., & Wilson Rankin, E. E. (2022). Community science reveals high diversity of nectaring plants visited by painted lady butterflies (Lepidoptera: Nymphalidae) in California sage scrub. *Environmental Entomology*, *51*(6), 1141-1149.

Connect urban farmers to useful insect data

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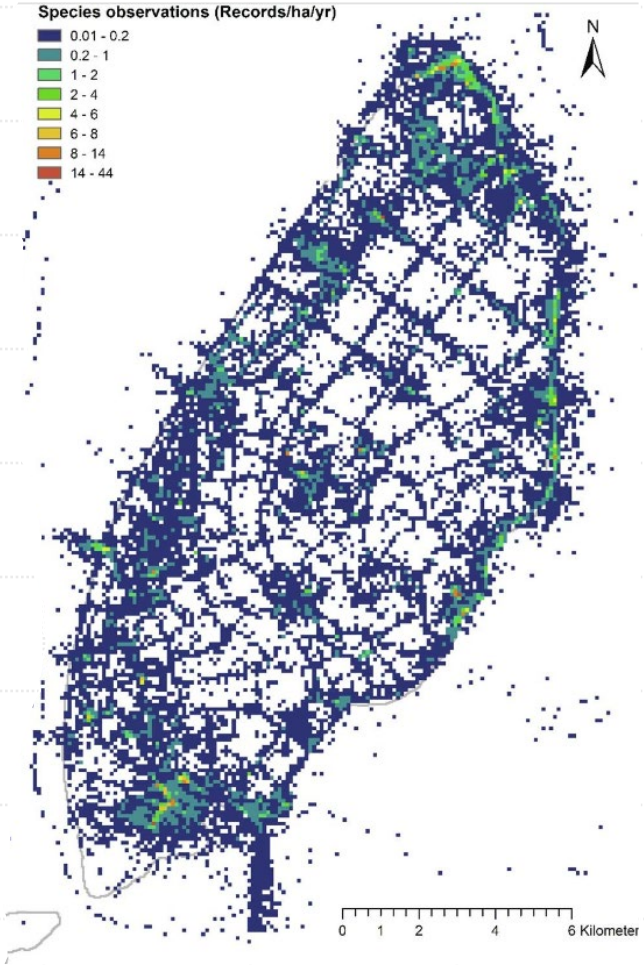

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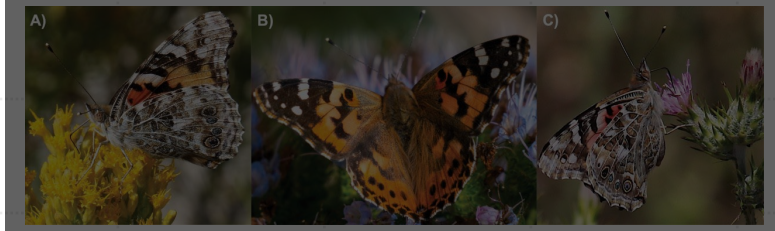

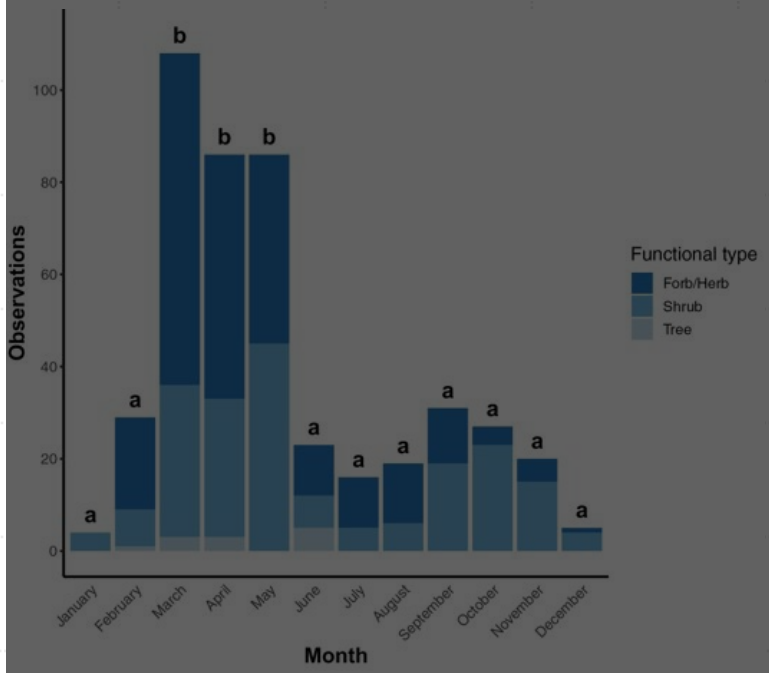

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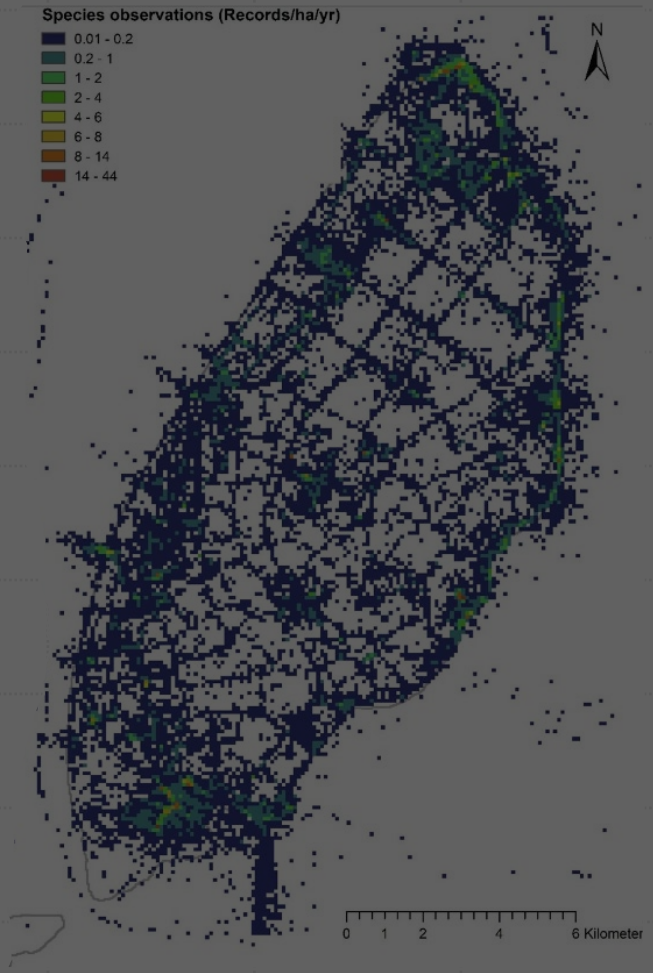

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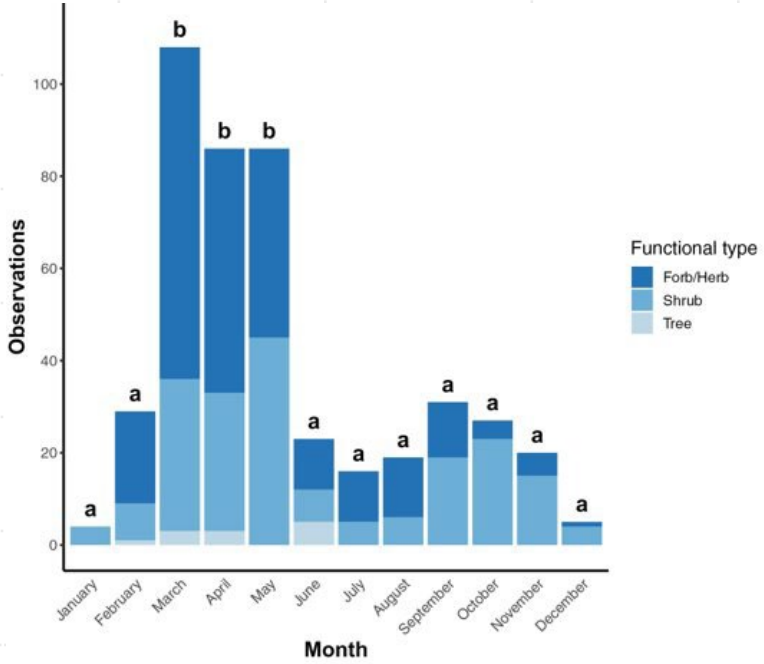

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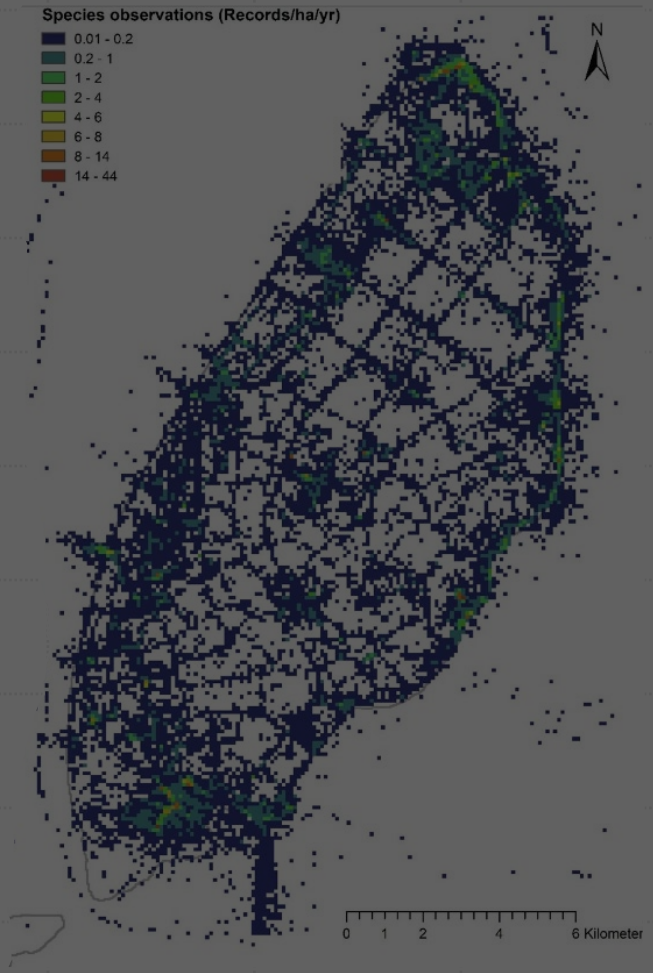

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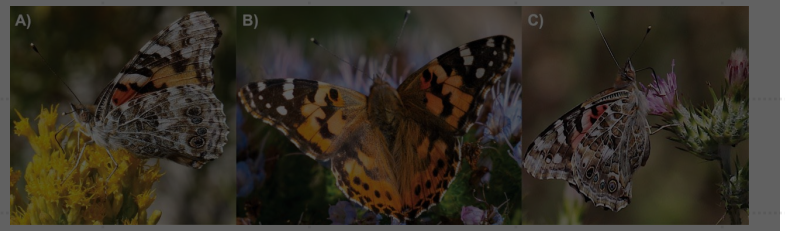

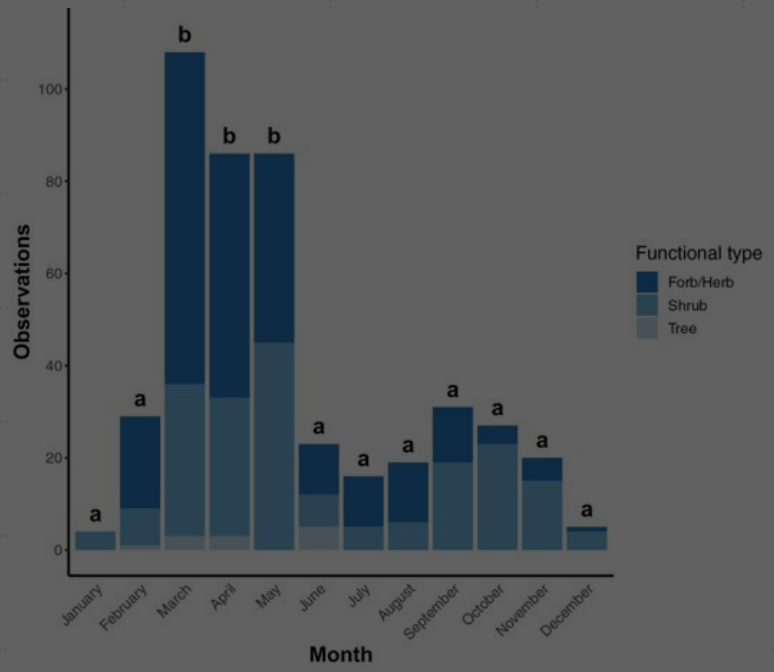

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Citizen Science in Policy

>20,000

Danaus plexippus ssp. plexippus 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(ii).

Report

Research Question

What is the frequency and type of citizen science use in policy documents?

Citizen Science

eBird

Citizen science as a valuable tool for environmental review

Corey T Callaghan[1*], Carly Winnebald[2], Blaze Smith[2], Brittany M Mason[1], and Laura López-Hoffman[2]

Human development and population growth are placing immense pressure on natural ecosystems, necessitating the establishment of a balance between development and biodiversity preservation. Citizen science may serve as a valuable resource for monitoring biodiversity and informing decision-making processes, but its use has not been investigated within the realm of environmental review. We sought to quantify the extent to which citizen science data are currently being used, mentioned, or suggested in environmental impact statements (EISs) by analyzing more than 1300 EISs produced under the US National Environmental Policy Act. Among the sampled EISs, we found increasing incorporation of citizen science within the environmental review process, with 40% of EISs in 2022 using, mentioning, or suggesting use of such information, as compared with just 3% in 2012. Citizen science offers substantial potential to enhance biodiversity monitoring and conservation efforts within environmental review, but numerous considerations must be broadly discussed before citizen science data can be widely adopted.

Front Ecol Environ 2024; e2808, doi:10.1002/fee.2808

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

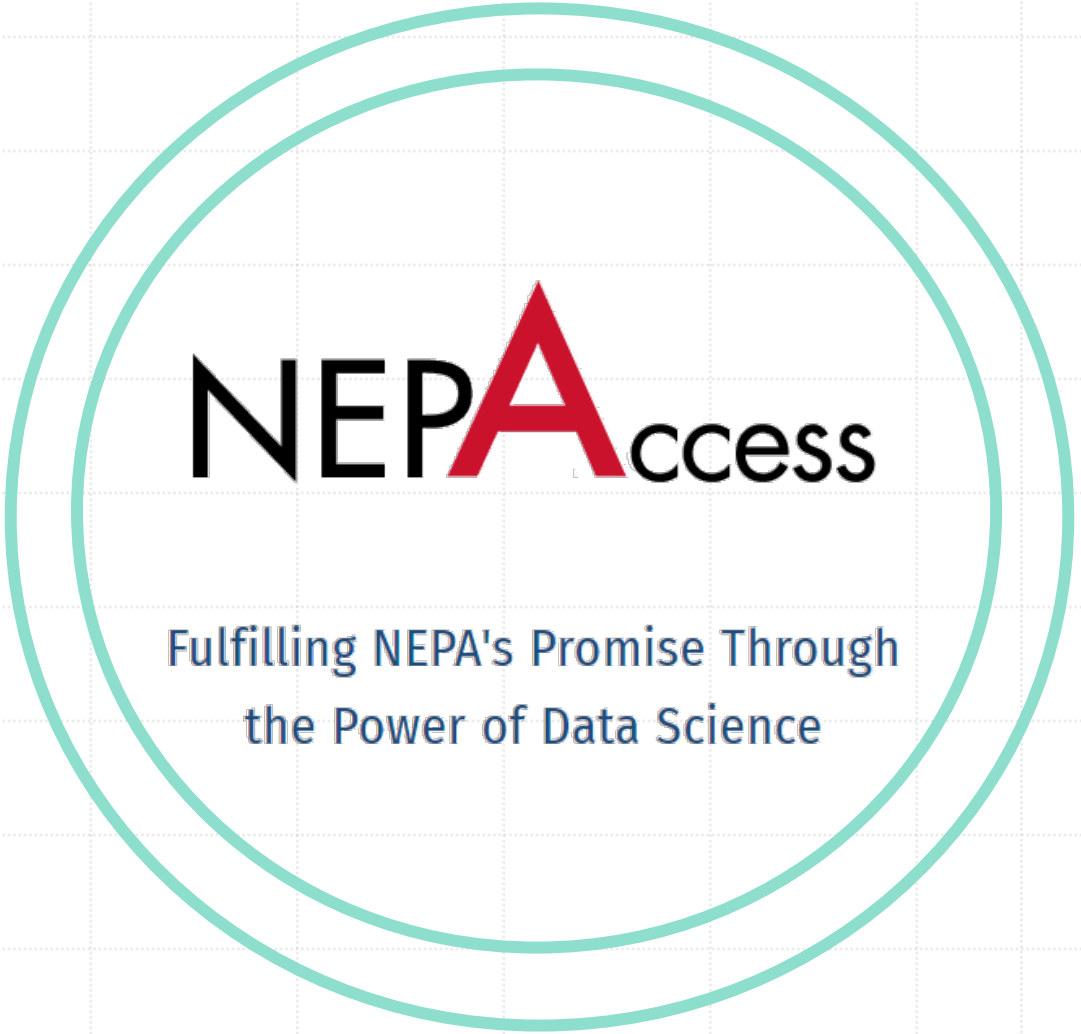
There are three levels of analysis under NEPA – Environmental Impact Statements (EIS), Environmental Assessment, and Categorical Exclusion

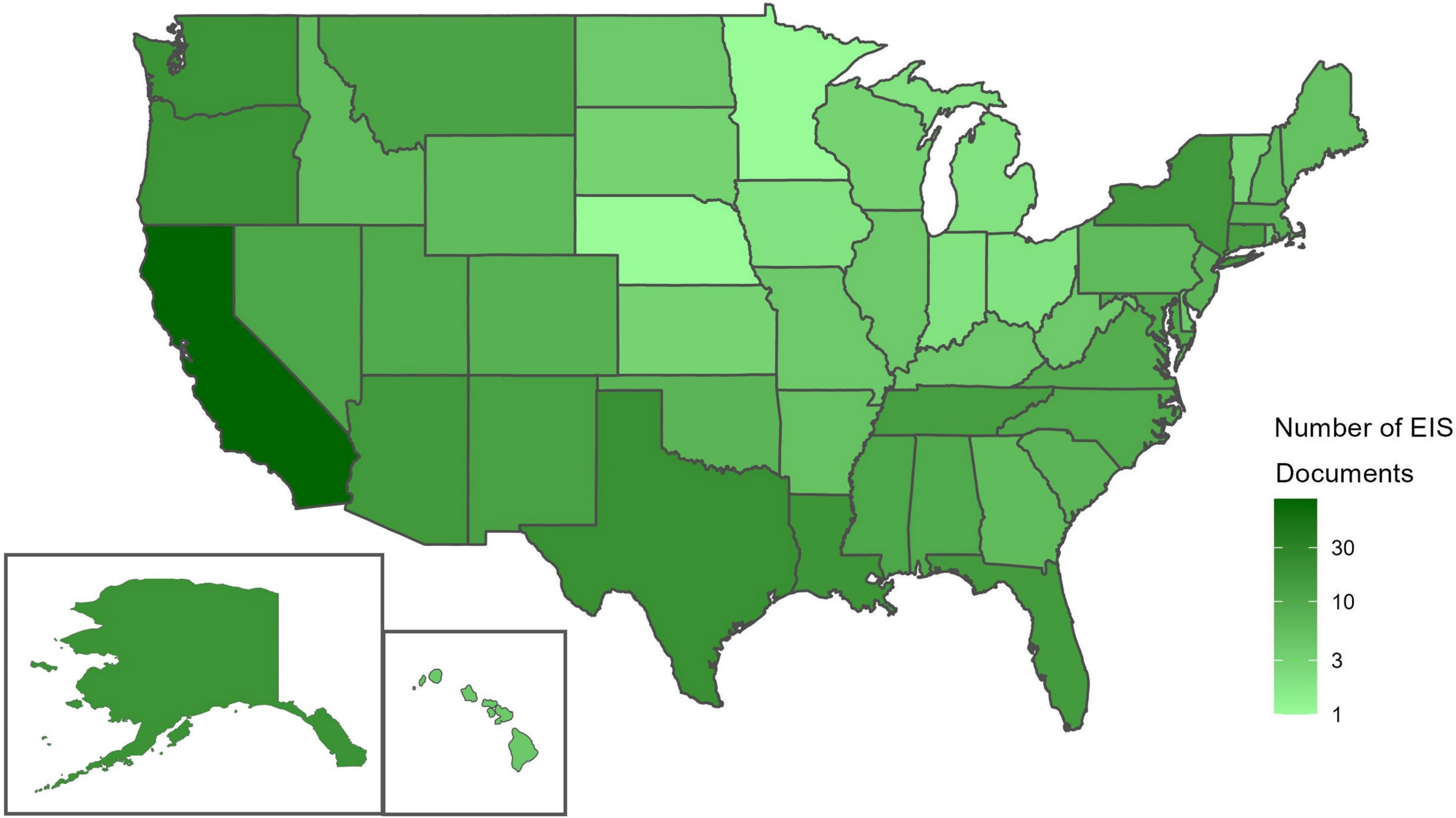
Environmental Impact Statement Search

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

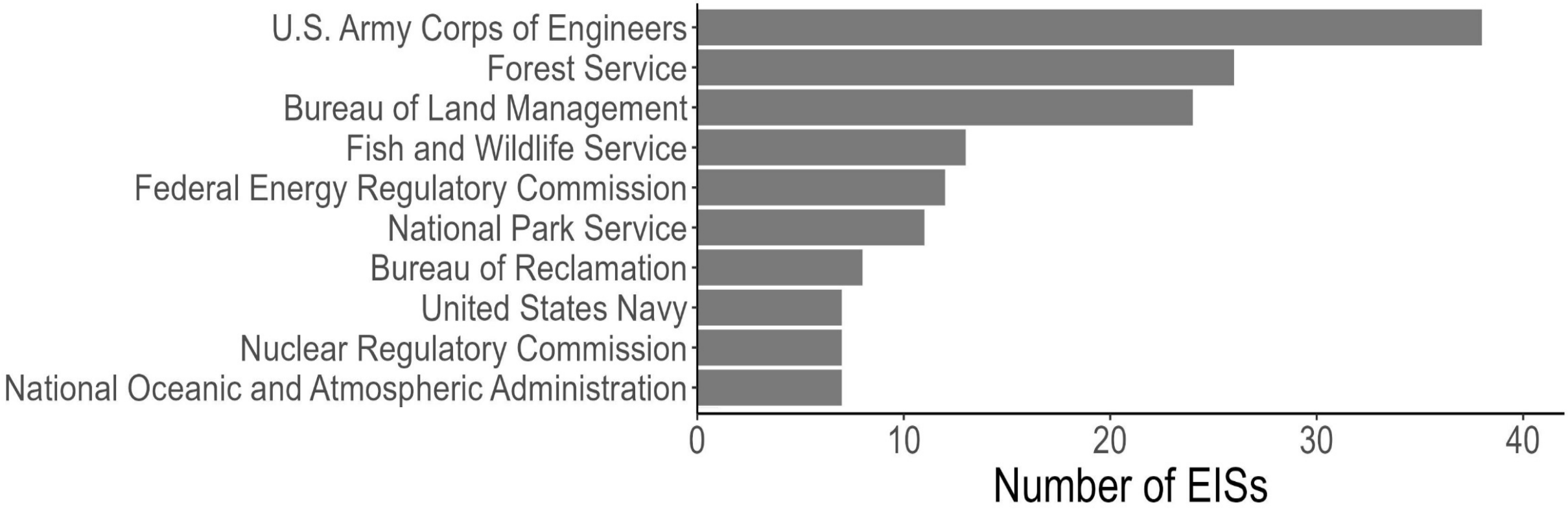
- Citizen science
- Community science
- eBird
- iNaturalist

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




Number of EIS
Documents
30
10
3
1

EISs using citizen science data were present across 45 agencies



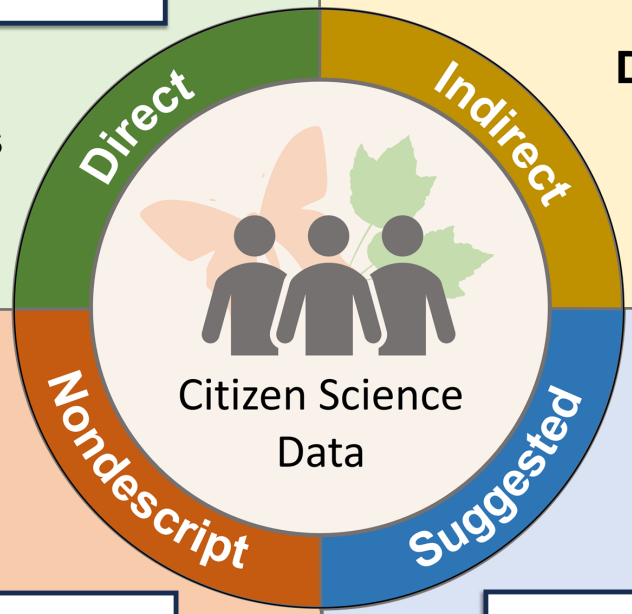
Presence: “In eBird, there are 687 records of 969 [olive-sided flycatcher] individuals on the Inyo National Forest” (Forest Service 2019).

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.

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

Definition: Background or reference material obtained from a citizen science platform.



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

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

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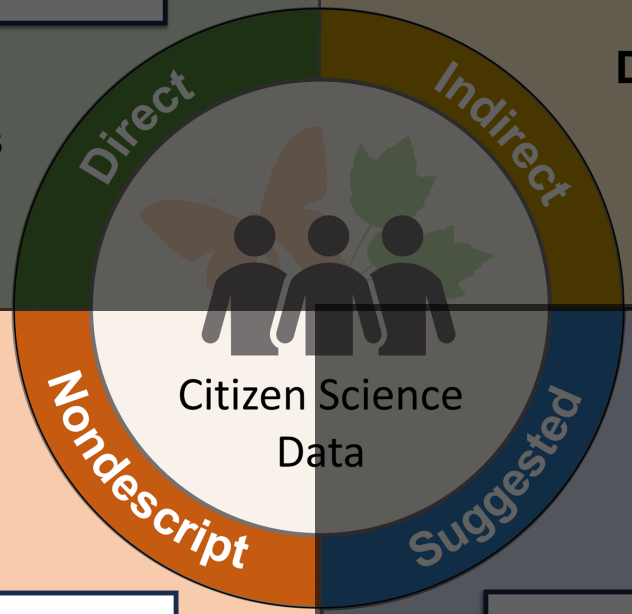

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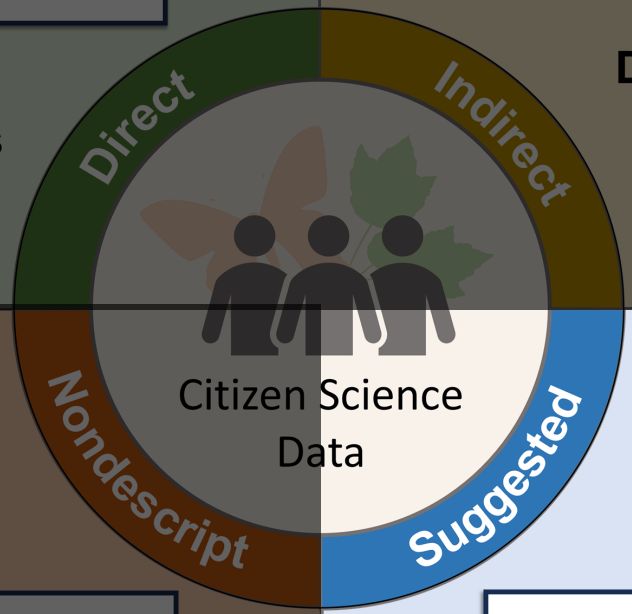

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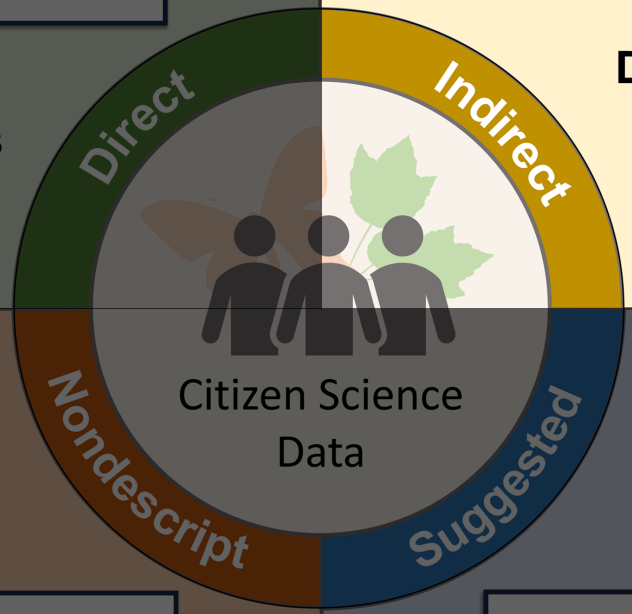

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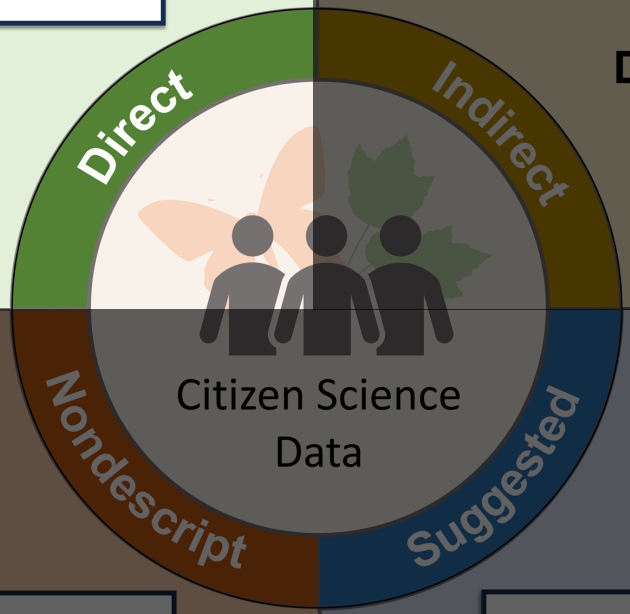

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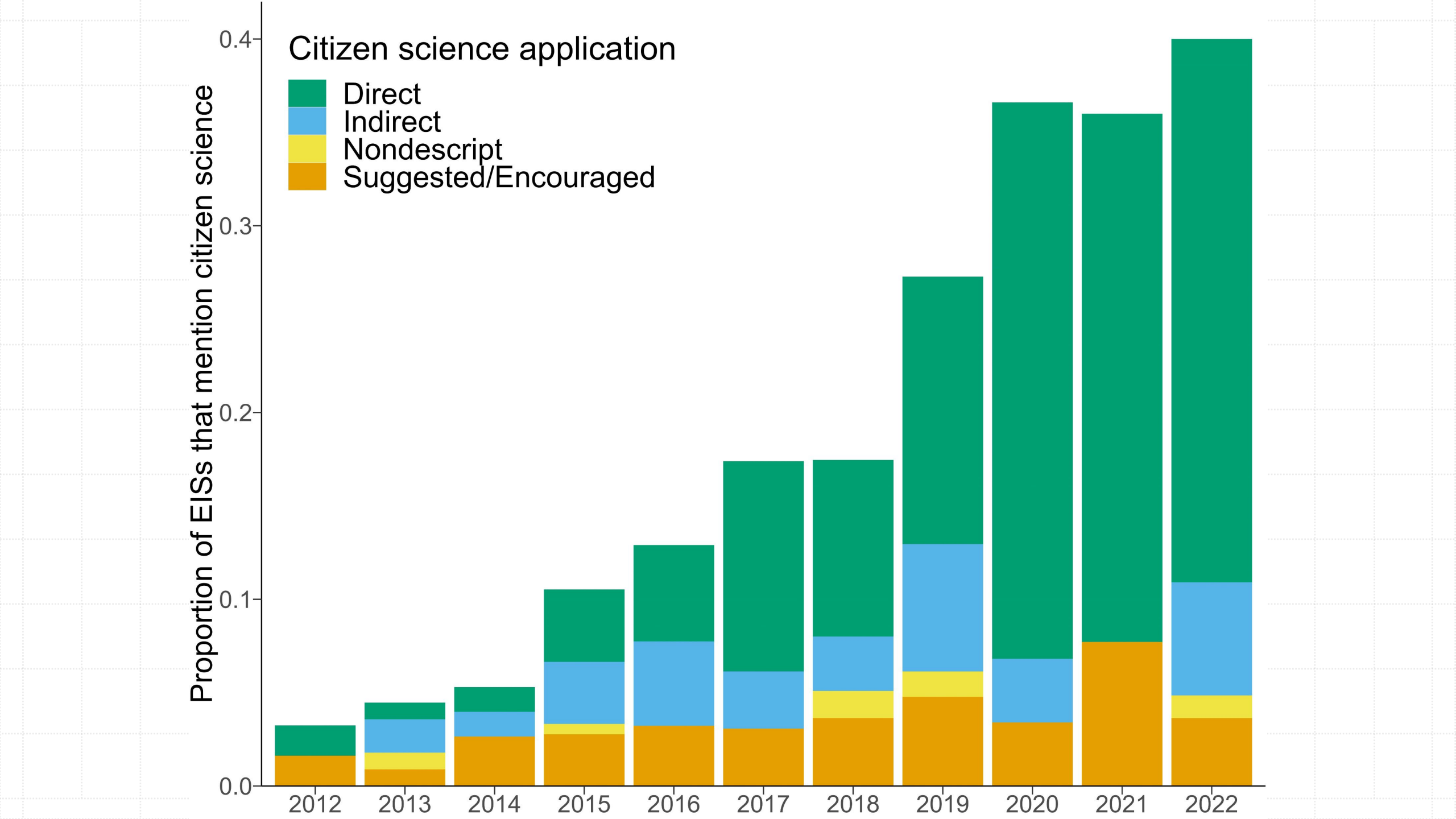
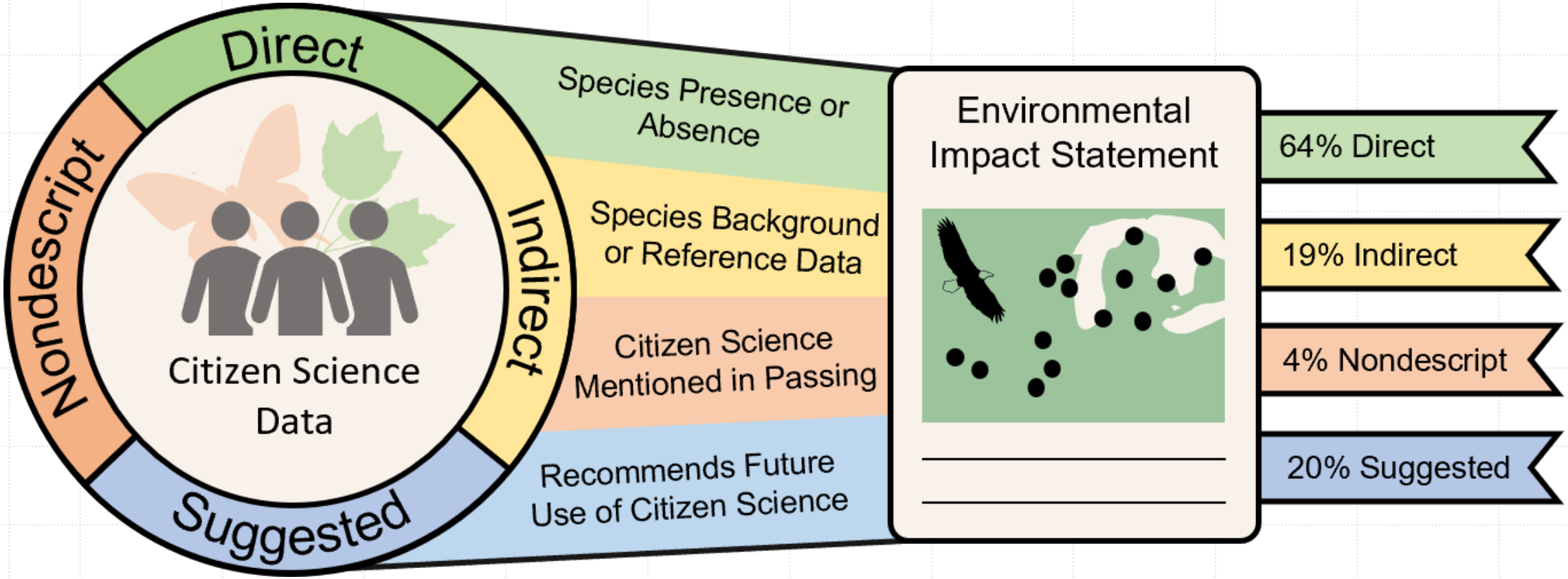
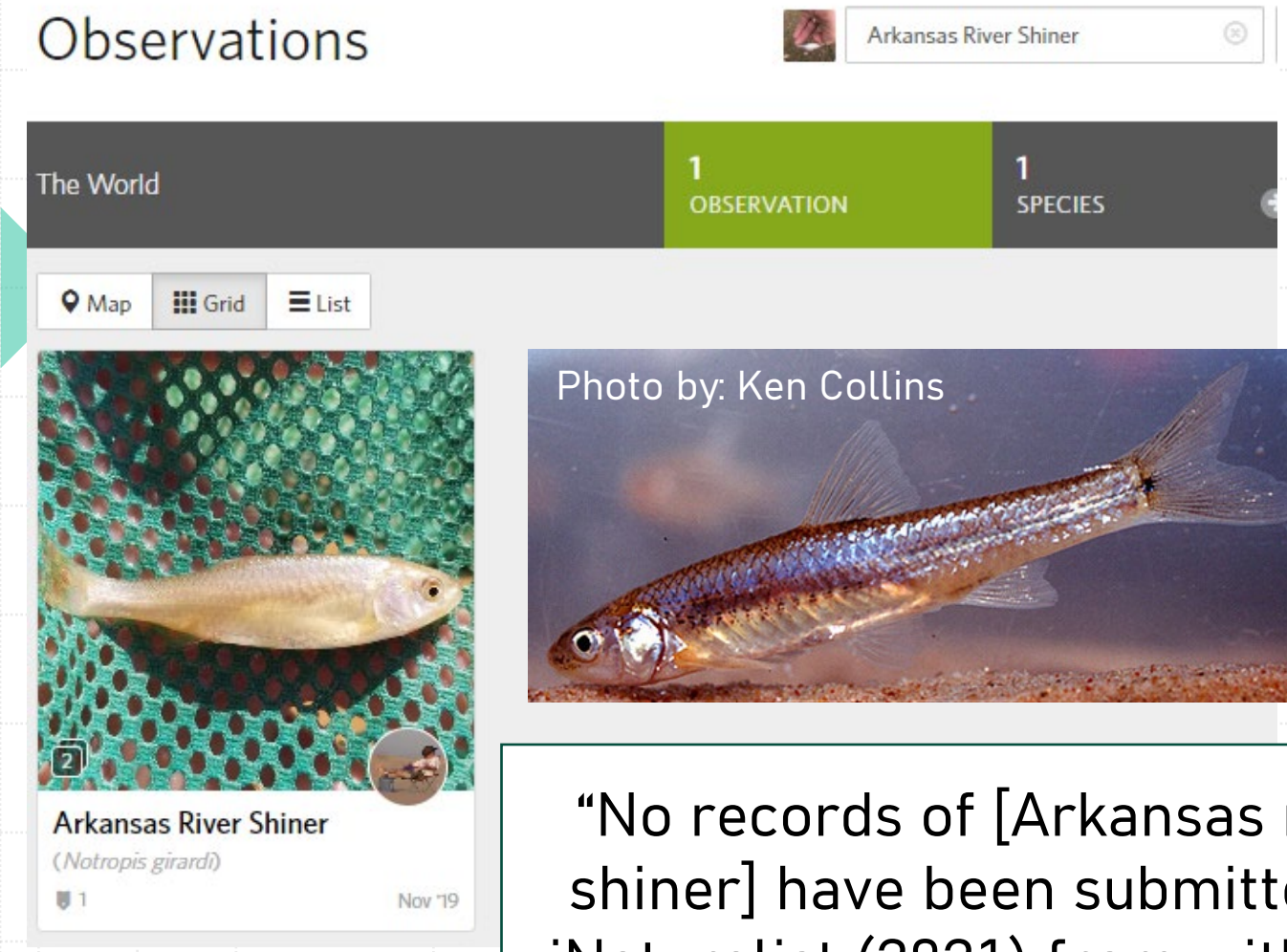

Citizen science application
Direct
Indirect
Nondescript
Suggested/Encouraged
Proportion of EISs that mention citizen science
0.0
0.1
0.2
0.3
0.4
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022

Numbers



87% eBird 6% iNaturalist



"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)

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

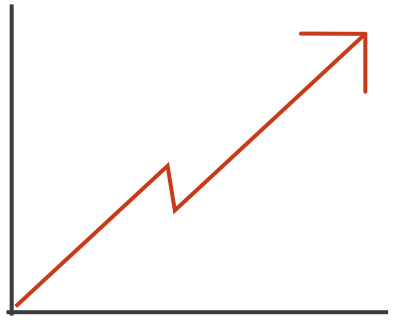
- Worthy of future discussion
- Not clear how they accounted for sampling effort or the iNaturalist location buffer for threatened species

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

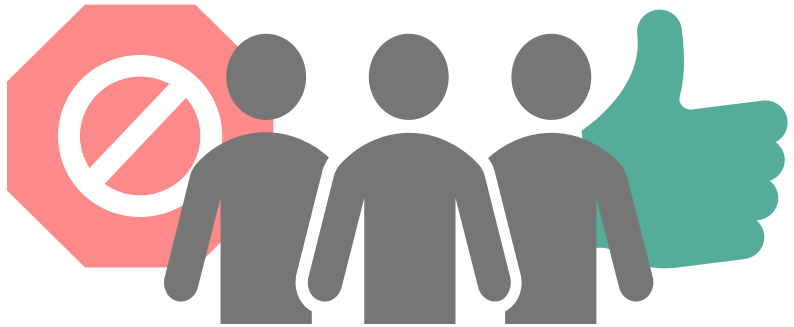


More Data

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

Take home messages

Citizen science democratizes the data gathering process, potentially leading to more informed and inclusive environmental governance.

Broader adaptation requires considerations around data validity, participant engagement, and policy alignment.

Our work highlights the transformative potential of citizen science in bridging the gap between community involvement and ecosystem service conservation.

Thank you!

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