Using iNaturalist to contribute your nature observations to science

Citizen submitted data collection is a rapidly expanding activity for citizen scientist and a popular tool for researchers. More and more citizens submit their nature observations to online databases, which in turn contribute to research across the world in biodiversity, climate change, and invasive species conservation.Citizens observations contribute to important research and scientists gain access to a larger data collection network. Popular programs like iNaturalist and eBird allow users to input their sightings of the natural world on their phone, and local experts help guide identifications of observations, engaging users further and creating communities.

iNaturalist (https://www.inaturalist.org) is the most popular general purpose biodiversity portal. It uses a community driven model to identify and vet observations that allows amateur to professional naturalists to contribute data without needing to be an expert. iNaturalist was created in 2008 with the goal to embrace citizen science data collection of biodiversity observations across the world and to help people learn about nature. Created originally as a collaboration between three graduate students at University of California Berkley, it was later funded by the California Academy of Sciences in 2014 and National Geographic Society in 2017. To date iNaturalist contains almost 13 million individual records of species ranging from fungi, plants, insects, and animals. iNaturalist has been used to study the spread of invasive species, presence of rare or hard to sample species, and been used to discover new occurrences of species across the world. Teachers and nature centers are increasingly using iNaturalist to teach students about topics including wildlife identification, climate change, and even limitations of machine learning.

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How iNaturalist works

iNaturalist works by accepting user collected presence data on individual species found, which they refer to as an “Observation”. Observations are singular, spatially and temporally referenced data points uploaded by a single user. Users can suggest their own identification of the specimen; however, every observation is subject to community vetting on the identification. Because of this, iNaturalist strongly recommends uploading photos or audio of species as supporting material. Users can input observations through their phone (which is the easiest method) or through the online portal, after which observations are entered into the iNaturalist database. While observations are generally entered singularly, a bulk option is available on the data portal.

When users upload a picture, iNaturalist attempts to identify and make suggestions about the identification of the specimen using their newly integrated machine learning software. This software uses local observations to weight the likelihood of identifica-
tions and give suggestions on possible species ID's. With each suggestion, iNaturalist links information like taxonomy and species descriptions (provided by Wikipedia) to help guide the user's decisions. Users can put in their best guess of the identification or simply “unknown” and allow the community to identify the observation. Ultimately, this allows any user, beginners and experts alike, to contribute to data collection without having to know anything specific about identification of that taxa.

iNaturalist allows you to upload pictures of your daily nature observations to the iNaturalist database. These observations are added to the 13 million other user submitted observations around the world.

Data validation

Once uploaded to the database, observations are then validated through a community identification effort. Each photo sample can be reviewed by any registered user on the website. Users across the iNaturalist community attempt to identify each observation down to the lowest taxonomic hierarchy possible. iNaturalist separates observations into two categories: “Casual” and “Research Grade”. Research Grade observations are the highest level of data quality and enter into the scientific database that is free to use for research purposes. To be considered “Research Grade”, observations must contain four initial criteria: A date, a spatial georeference, a picture/or sound, and are about naturally living organisms (not captive or cultivated). This implies that observations without visual or audio evidence are automatically assumed to be “casual grade” and do not enter the research database, stressing further the importance of entering photos or audio samples in iNaturalist. The first three criteria are easily produced with a cell-phone, as their camera typically records both the timestamp and the spatial coordinates using the GPS onboard.

You can upload pictures directly from your phone using the iNaturalist app. Once uploaded the photos are automatically georeferenced and possible identification are suggested via iNaturalists newly integrated machine learning software.

Identification then go through the community vetting process that requires at least 2 out of 3 additional users to agree on the identity of a specimen. iNaturalist attempts to facilitate discussion between users by weighting identifications higher that are contrary to the leading guess. The lowest level of taxonomy that reaches this threshold becomes the accepted identification. For example, say one uploads a picture of a large black bird. Four users agree it is some type of Grackle (Genus quiscalus), but two of them think it is a Common Grackle (Quiscalus quiscula) while the other two think it is a Boat-tailed Grackle (Quiscalus major). Because neither observation reaches the 2/3 threshold for identification to the species level, but the genus is accepted by 4/4 users the entry is accepted as a Grackle (just genus Quiscalus). If users agree above a 2/3 threshold on the species type then the submission is reentered as that new species.

These Research Grade observations are then entered into the Global Biodiversity Information Facility (GBIF) database. This international collaboration collates biodiversity records from scientific experts worldwide, and nowadays also includes citizen-science databases like iNaturalist, Breeding Bird Surveys, and eBird. At the GBIF website (https://www.gbif.org/), any user can download the gathered occurrence data for personal or research purposes.

Guiding identifications

To help users identify observations better, iNaturalist allows uploading of what they call “Guides”. These are online guide books of species in particular regions or taxa users expect to encounter. They can be tailored to individual projects (“Bird of the Everglades BioBlitz”) or specific and regional (“Noctuid Moths of South Florida”). This tool allows the community to steer users towards likely identifications and teach users about new things to look for as they explore. Anybody can create and publish a “Guide” using iNaturalist online tool, and later share it with a fixed URL they can share.

In addition to online guides, the website allows users to browse through the global database and identify others observations. From there you can help to identify specimens or learn key features in identifying taxa. iNaturalist attempts to foster a rich online community to help identify observations regardless of skill level. They do this by tracking users participation in identifying other observations and encouraging experts to include descriptions of how they identified specimens. The online community is strengthened by a strict adherence to their broad community guidelines. Hate speech, insults, harassment are strictly forbidden, and iNaturalist openly bans users who discriminate in any manner. More nuanced suggestions include not using all caps, avoiding sarcasm, and not justifying identifications using your credentials. iNaturalist’s collection of strict core rules and broad suggestive guidelines help to cultivate a helpful and accepting online community that is vital to the citizen science model.

The iNaturalist website collates your observations, tracks your statistics, and allows users to submit suggestions on the identification of your observation.
Projects and BioBlitzes

A strong emphasis for iNaturalist, is using its system as part of a project group. Termed “Projects”, iNaturalist uses this term as an umbrella to capture or enhance specific categories of observations. Simple projects can be a “Collection”, i.e. a collection of all observations with certain criteria. Collections act as a filter for observations so a project manager can more easily track and collect certain types of data (for instance creating a project for a state park, or on moths of Broward county). A “Traditional” project allows more complicated data collection options than simple observations. In a Traditional project, group administrators can ask for data that is not normally collected like the approximate area of an invasive species outbreak.

The most popular use of iNaturalist Projects is using iNaturalist for BioBlitzes, which are intensive citizen-science biodiversity surveys. This allows even inexperienced users to log observations for the BioBlitz and allows BioBlitz organizers to use iNaturalist as a convenient data portal. In a Traditional project, group administrators can ask for data that is not normally collected like the approximate area of an invasive species outbreak.

The easiest way to get started with iNaturalist is to sign up for iNaturalist and download the app. You can sign up for iNaturalist on the website or when you download the app. The process requires only an email, and a user name and password are chosen by the user. The app can be freely downloaded on Android or iPhone in their respective app stores.

Submitting an observation is relative straightforward on the app. When you find something interesting, you can either take a picture first and then upload it on the app, or take a picture directly within the app. If you take a picture outside of the app, once uploading the picture to the app you must hit the “Location” button to “Get” your current location or “Edit” to manually select a location. This is important because research-grade observations require to be georeferenced. After uploading the photo, you can go to “What did you see” and attempt to identify the specimen using iNaturalist suggestions, or leaving it as “Unknown”. If you are not able to identify the specimen, it is better to give it a broad taxon name like “Plants” or “Aves” or “Reptiles” before submitting. This allows the observation to be sorted and found easier for online community to identify later.

If you are in an area without cell phone service or Wi-Fi, then the observations will be stored locally on your phone, requiring you to hit “Sync” on the app when you get service to push observations to the website. For further information, there is a plethora of online user guides for download, use, and navigation of iNaturalist (https://www.inaturalist.org/pages/help).

Submitting your daily nature observations to iNaturalist is a fun and easy way to contribute to biodiversity research. iNaturalist’s robust apps and supportive online community facilitates interactions between users and builds a community that is vital to large scale citizen science projects. As iNaturalist’s user base grows, so the uses for this important data set. This makes it an increasingly vital tool for biodiversity research and a novel outreach tool for educators and scientists.