Introducing iNaturalist: Supplemental Instructional Resources for Learning to Use the iNaturalist Observation Collection System
NCBG Independent Study Project
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Project summary

iNaturalist, is a free, web-and mobile-app-based system that has been used by dozens of citizen science projects to collect, organize, and verify species observation data. The goal of this project was to develop instructional materials to supplement those available on the iNaturalist.org website. All resources developed for the project, including written, pictorial, and video resources are available at http://inaturalist.web.unc.edu. After these resources were published, the existing help pages on iNaturalist.org were expanded to include the two tutorials developed for this project, "Creating an Account & Changing Account Settings" and "Adding an Observation:" http://www.inaturalist.org/pages/video+tutorials.

Why iNaturalist?

The iNaturalist app is available for both iOS (Apple) and Android devices, distinguishing it from apps such as Leafsnap that are currently available on only a single mobile platform. Like the two systems most similar to it (Project Noah and Project BudBurst, which will be discussed below), iNaturalist also provides a web browser interface, making the system not only operating-system independent, but also device independent, allowing contributors without mobile devices to use the system.

The first iteration of iNaturalist was created by Nate Agrin, Jessica Kline, and Ken-ichi Ueda, information science graduate students at UC-Berkeley. iNaturalist is currently owned by iNaturalist, LLC, directed by Ueda and Scott Loarie, a research fellow at the Carnegie Institution for Science at Stanford (http://www.inaturalist.org/pages/about). iNaturalist supports dozens of citizen science projects (e.g., Ohio BioBlitz and Vermont Atlas of Life) and has partnered with other information providers such as the Encyclopedia of Life (http://www.inaturalist.org/project). iNaturalist makes its software code freely available for modification by other developers via open-source licensing (https://github.com/inaturalist/inaturalist). iNaturalist's user-support channels are transparent: anyone can join the iNaturalist Google Group to submit bug reports and questions (http://groups.google.com/group/inaturalist) that are not already answered on the iNaturalist help page (http://www.inaturalist.org/pages/help).

In their review of 32 citizen science projects, Wiggins and Crowston (2011) found that the initial development and ongoing maintenance computer systems supporting these projects have proven both resource-intensive and frequently unsustainable. Ready-made, free-to-use systems such as iNaturalist provide an important service to volunteer and underfunded initiatives. As mentioned earlier, the two other systems most similar to iNaturalist are National Geographic's Project Noah and the National Ecological Observatory Network's Project BudBurst. All three projects/services provide tools for collecting structured

observational data, including descriptive, photographic, and locational data , and all three enjoy the participation of educational programs and members of the public. Available evidence suggests that the computing infrastructure of each is maintained sufficiently for long-term use. Although iNaturalist's interface is not as streamlined as Project Noah's, which is designed to allow children to contribute as well as adults, iNaturalist is currently the most accessible and flexible system for adult amateur and professional use, for two key reasons: its open, collegial structures for participation and its degree of data portability.

Both Project BudBurst and Project Noah support educational use and provide some data export capabilities. Underway for over five years, Project BudBurst has developed curriculum guides for instruction of K-16 educational groups and also offers online professional development programs for educators. Begun in 2011, Project Noah now offers several sample lesson plans, and, to educators registered as such with the system, the ability to create "missions," specific observation assignments for students that allow instructors to track student activity, map observations, and export student datasets. In contrast, access to data collected for Project BudBurst is not limited to educators and project leaders: affiliated scientists review and curate the data collected during a calendar year and, the following year, make it available for public download. There are no such embargoes on data submitted to iNaturalist: it is immediately viewable, searchable, and available for export by anyone with Internet access and a web browser, allowing for expedient data reuse and secondary analysis. In some cases such openness is arguably undesirable, such as in recording the location of endangered plants with a history of illegal harvesting. In such cases, the NatureServe conservation status for these species comes into play, and coordinates displayed to users other than the contributor are obscured automatically (Figure 1).

Figure 1: Observation coordinates obscured according to species' conservation status.

In addition, observation locations can also be obscured manually by contributors.

Curation of Project BudBurst data is handled by a select group of users; in iNaturalist, both observational and taxonomic-reference data can be curated by anyone with an iNaturalist account. Curation of observations is a process in which any user can participate: when an individual submits an observation, other users may post identifications. An identified observation moves from an initial Daily Quality Assessment of *casual* to *research grade* if a) two or more users agree on the species and b) a photograph, location of the observation, and the date the observation was made are included (Figure 2).

Figure 2: Data Quality Assessment details for a research-grade observation.

Taxonomic-reference data are editable by anyone given a system curator role, and this privilege can be requested by contacting help@inaturalist.org. There are currently forty system curators. I sought curator access after noticing that *Acer floridanum* was still listed as *A. barbatum*. After my account was given curator access, I was able to deprecate *A. barbatum,* designating *A. floridanum* as preferred (Figure 3).

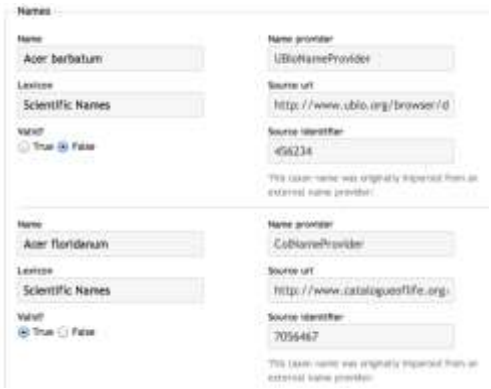

Figure 3: Curation options for taxon name.

iNaturalist draws its taxonomic data for plants primarily from the Catalogue of Life's annual species checklists, but it also incorporates data from many other sources. Each taxon page links to available descriptions from Wikipedia and the Encyclopedia of Life (EOL), as well as linking to the Biodiversity Heritage Library (BHL) and the Global Biodiversity Information Facility (GBIF). iNaturalist began sharing its data sets with GBIF in March 2013, exporting observations that have met certain criteria for quality and that were licensed under Creative Commons by observers.

Places and projects

Any iNaturalist user can create a project site to collect and validate observations submitted by other project members. To spur competition, project owners may choose to enable leaderboards to acknowledge members submitting the greatest number of species observed or of total observations made. Rules can also be applied to projects to constrain observations to those that are, for example, geo-located, found within a defined geographic range, belong to a specified kingdom, or match a pre-defined checklist of taxa. For the purposes of this project, I chose not to create a project, but instead created a “place” site for the NCBG

Piedmont Nature Trails area, which involved simply naming the place and defining its boundaries on a map (Figure 5).

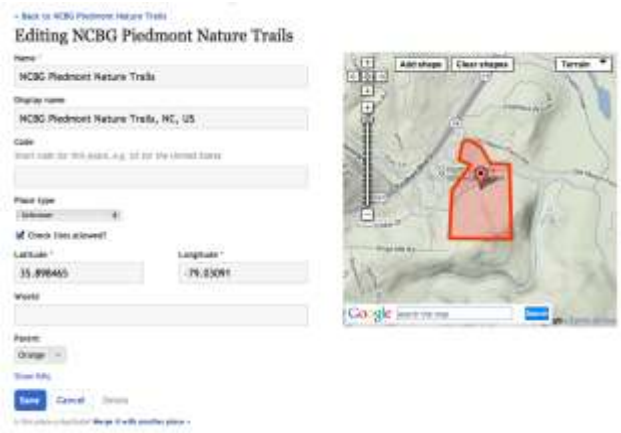

Figure 4: Editing options for an iNaturalist place.

Observations with locations falling in this area made by any user will automatically be included in the list of observations for the area: http://www.inaturalist.org/observations?place_id=54516. One drawback of this approach is not being able to require users to record certain data. For example, NCBG volunteer coordinator Grant Parkins mentioned the desirability of including basic phenophase information (i.e., flower and full-fruit) for observations. Creating a project would be necessary to insure that contributors included this information in observations.

As with projects, places can have associated checklists. I met with Carol Ann McCormick, Associate Director of the UNC Herbarium, to discuss the 1993 inventory she had taken of the area. in 1993. McCormick noted that Rickie White had subsequently inventoried the area in 1999. Upon review of White's list, I discovered that it combines taxa from all Garden properties into a single list, so I chose to use McCormick's older, but location-specific list to create the plant species checklist for the area: http://www.inaturalist.org/places/ncbg-piedmont-nature-trails. Adding species names to a checklist automatically links each species to Creative-Commons-licensed photos and descriptive information drawn from Wikipedia and the Encyclopedia of Life. This information could prove useful to contributors of observations, providing a resource to aid species identification.

A resource designed to introduce iNaturalist users to how places and projects can be used is available at http://inaturalist.web.unc.edu/places-and-projects.

Usability issues

Taking photographs, recording descriptive information, and then posting this information online is fairly straightforward; however, any system has infelicities and takes time to learn to use. My own experience using the system as well as firsthand observation of and secondhand reports from other users have pinpointed a few issues that negatively affect iNaturalist's usability. Addressing these issues has shaped the focus of the instructional materials that I have developed. This section describes two issues in greater detail:

slowness of photo uploads and using the map interface to manually geo-locate an observation.

After adding setting up an account and adding two observations using the iNaturalist website, NCBG faculty member Stephanie Jeffries reported that she found the process of adding observations, particularly uploading photographs, to be slow. When she asked members of her 2013 Plant Ecology class about their experience using the system, the one student who created an account and added observations reported slowness as well. A fellow student in the 2013 Winter Flora course who was using the iNaturalist mobile app wondered if I "was finding iNaturalist incredibly slow at uploading posts" (Whaley, 5 Mar 2013). This slowness for all three users stems from the fact that all uploaded photos are stored on iNaturalist's own servers rather than on the photo-sharing sites that are integrated with iNaturalist: Facebook, Flickr, and Picasa/Google+. Both iNaturalist's help documents and my own subsequent experience using all four external storage options point to the same conclusion: submissions process more quickly if the associated photos are stored on one of these services. However, for those who wish to use the iNaturalist app to take photos, storage on iNaturalist is the only option. The feedback that I have gotten from the two NCBG students who've used the mobile app has been chiefly positive, with one report of slowness, mentioned earlier, and another proclaiming how easy and convenient iNaturalist is to use. My personal experience has been that syncing observations over a WiFi connection speeds the upload process. Users will be likely be less frustrated if they know this in advance and wait to sync from home rather than out in the field with a cellular connection.

Observations can be geo-located in two ways: a) automatically, using the mobile app on a GPS-enabled device or b) manually, using a Google Maps interface in the web browser. The panning and zooming required to specify a location manually is arguably the most "click-intensive" and time-consuming step in contributing an observation. Entering an address, street, or city and allowing the map to zoom in to that location can save time and effort. It is also useful to know (and may not be obvious) that the default pinpoint for a location can be broadened into a circle to indicate an approximate location. GPS-enabled devices add these circles of accuracy/uncertainty automatically (Figure 4).

Figure 5: Observation map showing manually-specified location.

GPS accuracy can be improved by prompting the app to receive updated location data. Of the 77 observations I have made using the Android mobile app, accuracy has been good, ranging from 5 to 11 meters.

The two usability issues described in this section are addressed in "Tips for adding observations in a

web browser," both in the written instructions on that page and in the embedded video, "Adding an Observation." On June 1, 2013, I led an iNaturalist workshop for small group of environmental educators. The materials that I created for this workshop were revised into two resources: "Account creation and settings" and "Identification tips." The experience I had working with the workshop participants, all of whom brought mobile devices with them, informed the development of "Tips for using the apps."

References

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