



City Nature Challenge

St. Louis Metro

Educator Guide

ST. LOUIS-ST. CHARLES-FARMINGTON, MO-IL COMBINED STATISTICAL AREA





iNaturalist is based at the [California Academy of Sciences](https://www.calacademy.org/)

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Taking Part is Easy



Find Wildlife

It can be any plant, animal, fungi, slime mold, or any other evidence of life (scat, fur, tracks, shells, carcasses!) found in your participating city.



Take a Picture of What you Find

Be sure to note the location of the critter or plant.



Share Your Observations

By uploading your findings through iNaturalist or your city's chosen platform.



Welcome!

In 2013, in response to emerging research supporting the notion that urban nature conveys many social, economic and environmental benefits to residents, the City of St. Louis launched the ‘Urban Vitality and Ecology (UVE)’ initiative. This multifaceted project promotes city-wide programs and practices that advance eco-literacy among residents and strives to ensure all have access to quality natural spaces. In the years since, St. Louis has partnered with local businesses, schools, organizations and residents to improve local parks, create native and pollinator-friendly city gardens, and promote understanding and awareness of environmental concerns that affect our region.

One of the objectives of the UVE initiative is to create an urban biodiversity inventory for the city that can inform policy and planning decisions. If we have a sense of what plants, insects and wildlife are relying on our natural spaces (and which should be, but currently are not), we can take the welfare of these species into consideration when making decisions that affect those spaces. In the surrounding counties, a collaboration of organizations known as OneSTL has initiated a similar effort to create an inventory of the region.

A biodiversity inventory is a huge undertaking! While St. Louis is home to many experts in natural fields, they cannot do it alone! For this reason, we need the help of residents, teachers and students who can document the plants and wildlife they encounter in their neighborhoods.

Thanks to iNaturalist, you and your students can significantly contribute to this project! Take a walk in your neighborhood, snap photographs of plants and animals you encounter, record some simple observation data, and submit them to the iNaturalist site. This manual will provide you with key guidelines to keep in mind, tips for success, and resources that you may find helpful.

By helping us in this effort, your students will be making a very real, very important contribution to the urban ecology efforts our city and surrounding region! Thank you!



Project Background

What is a Biodiversity Inventory?

A ‘biodiversity inventory’ is simply a listing of species found living in a given region. As the name implies, the goal is to document the diversity of living things that live, reproduce and thrive in a given area, as opposed to counting how many individual organisms might be living there. In general, an ecosystem with a higher level of biodiversity is ‘healthier’ than one with low or poor biodiversity.

These inventories are valuable tools. Scientists and conservation agencies create biodiversity inventories to identify areas that might be good candidates for study, or require ecological restoration. Agricultural professionals and city planners may reference a biodiversity inventory in an area targeted for development to gauge potential disruption to ecosystems by human activity. Citizens of a region can also benefit from access to a biodiversity inventory to identify plants, insects and other organisms that appear in their community, and learn how their activities affect these organisms and vice versa.



Depending on the purpose of the inventory, the list may be focused narrowly on one group of organisms (i.e. - all of the plants growing in a given lot or field, or fish species living in a given body of water), or it may attempt to include all living things in the area. The latter is called an **All Taxa Biodiversity Inventory (ATBI)**. A truly complete ATBI takes a lot of work and time to compile and needs to be updated regularly as local populations change, but even a partial inventory can tell us a great deal about the natural world around us.

What is Citizen Science?

The larger the area being studied, the more challenging it can be to inventory the biodiversity it supports. The best way to inventory biodiversity is to be out in the field, observing and documenting it firsthand. As our interest in ecosystem functioning becomes increasingly more global, scientists have reached out to citizens to ask for their assistance with observing and cataloging the living things around them.



These ‘citizen science’ efforts are a great way to introduce students and communities to the importance of and practices inherent to science work, notably careful observation and data collection. In most cases, participants submit this data using “smart” device applications (apps) and/or websites. Scientists review the submitted data, check it over for accuracy, and include it in their study for analysis.



Today, a wide variety of citizen science opportunities are available. iNaturalist, for example, is broadly focused to create an ATBI for a given region. Others document the range of specific species or groups. There are also citizen science projects in which observations are made concerning how living things move and change over time (phenology). For a list of citizen science opportunities that may be of interest to you or your students, see the Resources page at the back of this guide.

What is the 'City Nature Challenge'?

The **City Nature Challenge** was organized in 2016 by Lila Higgins at the Natural History Museum of Los Angeles County and Alison Young at the California Academy of Sciences. They challenged the citizens living in and near Los Angeles and San Francisco to submit iNaturalist observations describing the living things they found in their parks, lawns, schoolyards and public spaces. Over that first eight-day event, more than 1,000 residents submitted observations and documented more than 1600 species.

In 2017, the CNC expanded into a competition between 17 cities across the United States, In 2018, challenging municipalities to see who could engage the most citizens to participate, submit the most observations, and identify the most species. In 2018 the field expanded to include 65 cities worldwide, and in 2019, the field of competition swelled to over 160 metropolitan areas around the globe!

The City Nature Challenge is held annually across 8 days, usually beginning the last weekend in April. All participating cities take part on the same dates, and the activities are broken out over two four-day periods:

Observing: Days 1-4

During this time, residents of participating regions collect observations by photographing and recording as many living things in their regions as possible. They can upload these observations as they go (recommended), but can also upload observations during Days 5-7 as long as the photos and recordings were taken during Days 1-4.

Identifying and Verifying: Days 5-8

During the latter portion of the event, iNaturalist members in each region review incoming observations and either identify the organisms or verify identifications others have made.

CNC St. Louis Guidelines

For your students' observations to be included in the challenge, the following guidelines **MUST** be observed:

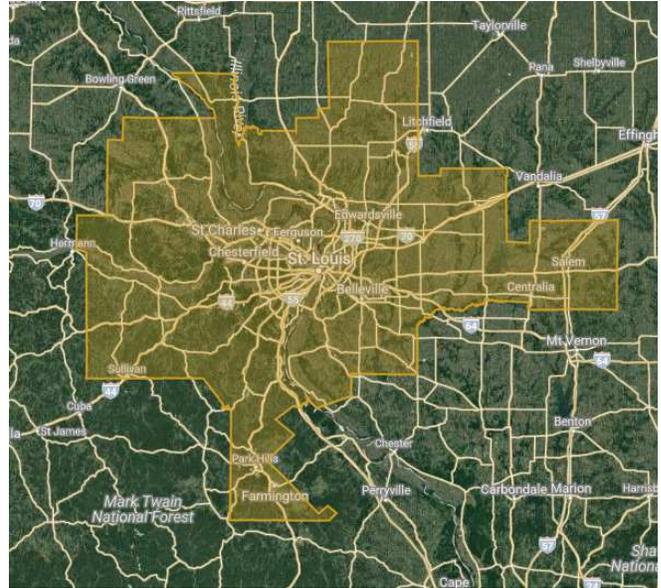
- **Media files must be included.** Only observations that include at least one photo (preferably more) or an audio file of calls will be counted toward the region's total for the event.



- **All observations must be made during the Observing Days.** Observations may be entered during the Verification and Identification days, but the media files they include must have been created during the Observing Days period.
- **All observations must be made within the region designated.** The St. Louis project will include the following counties in Missouri: St. Louis, St. Louis City, St. Charles, Jefferson, Lincoln, Franklin, Warren, Washington, and St. Francois.

The region also includes the following counties in Illinois: Calhoun, Jersey, Madison, St. Clair, Monroe, Clinton, Macoupin, and Bond.

- **Organisms observed should be 'wild'.** Pets, livestock, houseplants and food plants/crops should not be subjects of observations. Landscape plants, trees and shrubs that were planted before September 2017 are acceptable.





Using iNaturalist

iNaturalist began in 2008 as a Masters' project designed by students at the University of California - Berkeley. Ten years later, the community comprises a population of more than 500,000 users worldwide that has recorded more than 7 million observations. The platform has become the go-to citizen science application for biodiversity study. It is a fun, easy tool to use, and is largely what makes the City Nature Challenge possible!



What You Need

To use iNaturalist effectively, you need the following:

- A digital camera
- A digital audio/MP3 recorder (optional, but handy if you are observing birds, frogs or insects with distinctive calls)
- A means of documenting data
- An internet connection

If you have a tablet or smartphone, you probably have all of these requirements in one device. Otherwise, a digital camera/recorder and a notebook are fine for making observations in the field, and you can upload observations through the iNaturalist.org website when you're done. A sample Observation Data sheet has been provided at the end of this guide that you are welcome to use with students if desired.

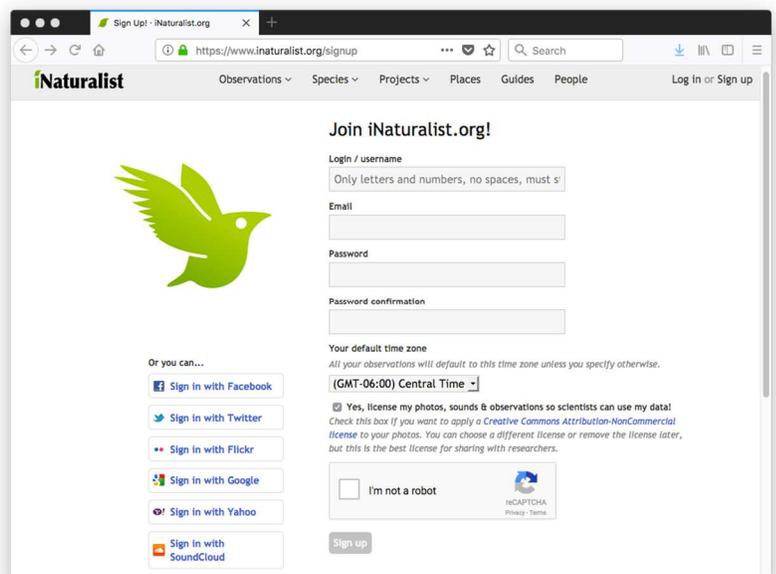
Getting Started

Visit www.inaturalist.com and click on 'Sign Up' to create an account. Creating an account is free, and there is no charge to use the site or the app.

You can create login credentials specific to iNaturalist, or you can log in using Facebook, Twitter, Google, Flickr or Yahoo.

Class accounts vs. Student accounts

As a teacher, one of the first questions you'll need to answer for yourself is whether you want to upload your students' observations to one class-wide account, or have each of your students create their own accounts and upload their observations themselves.





Keep in mind that iNaturalist is a social media platform as well as a data-gathering tool. Given this, creating accounts for children 12 years of age and younger is a violation of COPPA (Children’s Online Privacy Protection Act) guidelines. Therefore, if even one student in your classes is under the age of 13, you should use a classwide account.

Observations vs Projects

An ‘Observation’ is a record of an encounter with an organism. A ‘Project’ is a collection of observations that fit a certain criteria, such as location, timeframe, taxa, media type, observation quality, and observer.

The City Nature Challenge is a Bioblitz project. All observations made in the combined statistical area surrounding St. Louis (location) on the Observing dates of the event (timeframe) will appear in the project.

One observation may appear in multiple projects. Observations made during the City Nature Challenge that reach ‘Needs ID’ status will also automatically be added to BiomeSTL Regional Biodiversity Inventory project.

Creating Observations

The first four days of the City Nature Challenge span two weekdays and two weekend days. You and your students are welcome to collect observations throughout the event.

The following tips will help your students observe safely and create good quality observations:

- **When in doubt, try to take three photos of what you are trying to observe.** Take from different angles and at different distances to give identifiers multiple views to observe, and whenever possible, **make sure the organism you are observing is centered and clear.** Be mindful of the background.
- **Avoid disturbing the organism if you can.** Not only is this safest for the organism, it's also safest for you. If you do capture insects or other small critters, place them temporarily in a jar to photograph them, then release them as near to where you found them as possible.
- **Use a dark-colored clipboard as a backdrop when photographing leaves.** Identifying plants visually often depends on small details, such as the edge of a leaf, the vein patterns, etc. Using a dark backdrop can sometimes make these details clearer.

The image displays two screenshots from the iNaturalist website. The top screenshot shows the project page for 'City Nature Challenge 2018: St. Louis, MO'. It features a banner with a photo of a city skyline and a 'Recent Observations' section. A red circle highlights a specific observation of a Killdeer. The bottom screenshot shows the detailed view of this observation, including a photo, a map, and a list of projects it is associated with. A red circle highlights the 'Projects (2)' section, which lists 'Add to Project' and 'Biome of North America'.



- **Size references are a big help.** Carry a ruler with you and include it in your photos when you can.
- Use a **sound-recording app** can be used to record wildlife calls. Any app that can record to a *wav*, *mp3*, or *m4a* format can be used for this. (Note: sounds can only be uploaded via the website at this time. You cannot add sound files via the app.)

Finding Wildlife to Observe

As plants do not move around much, they tend to be the easiest to observe. However, remind your students that even easy observations require attention paid to detail. The following list lays out some good advice for locating and observing various organisms common in our area:

Plants

- When observing **trees and shrubs**, try to take: 1) a photo of the whole organism (or as much of it as you can fit into the frame), 2) a close-up of its bark, 3) a closeup of a branch in which leaves, flowers and fruits are clearly visible. If the undersides of leaves is unusually colored or textured, photograph those, too.
- When observing **non-woody plants** (including yard weeds, grasses, and wildflowers), try to take: 1) a photo of the whole organism, preferably with a ruler or other size reference visible, 2) a close-up of either leaves or flowers (preferably both), and 3) a closeup of the stem, if it's visible. It's often helpful to note whether any parts of the plant are hairy or prickly in your observation.
- When observing **mosses or lichen**, take at least one photo at enough of a distance that the surface upon which it is growing is clear, and one close up so that the structure is clearly visible.

Insects/Arthropods/Etc.

- Turn up stones or rotting logs to observe **soil organisms**. It's sometimes best to partner with someone when you do this, as these critters tend to flee when exposed to light. Have one partner turn up the log or landscape stone while the other takes photos. **Always replace the log or stone when you're done.**
- Visit porchlights in the evenings to observe **moths and night-flying insects**. Experiment with using flash to take the photos; depending on your camera, the porchligh alone may be too dim to make details distinct.
- Examine plant leaves and bark for **evidence of insect activity**. Examples include twisting tunnels under bark or inside leaves, leaves that have been partially eaten, galls on branches, holes bored into bark, or webbing. Observations of these kinds of evidence are often identifiable even if the insect itself is not visible.
- Depending on how warm the season has been, you may be able to record **crickets** in the evening. Try to get close enough to a cricket that its song is clear above other ambient noise.



Birds

- Go out early in the morning and try to record **birdsong**. Follow a song you hear to find its singer, and get close enough so that its song is clearer above any other birds singing nearby. Photos of birds taken at a distance are usually identifiable when coupled with a recording of their song.
- Take photos of **evidence of birds**, including footprints, droppings and feathers. You can also photograph nests and eggshells, but be careful not to disturb parent birds that are raising young. If it's clear a nest is in active use, photograph from a distance.

Amphibians

- Go out in the evening during the breeding season (February to August) and try to record **frog and toad calls**.
- Look for **tadpoles or clusters of eggs** in shallow pools. Include photos showing the entire body, head, and tail of tadpoles.

Reptiles

- **Look for reptiles** sunning themselves on warm surfaces, like rocks.
- **USE CAUTION!** Photograph from a distance by using the zoom feature on your smartphone to get close-ups. Try to capture a good photo of the head and body.

Mammals

- **Dogs and cats that are feral** are fair game for observations, but please report them to your local Animal Control. If you see strays wearing collars, don't observe them; try to connect them with their owners.
- Look for **evidence of mammal activity**, including discarded nutshells and fruits, footprints, and droppings/scat.

Photography Guidelines

Taking photos in the iNaturalist app on a tablet or smartphone is convenient, but you can also use a standard digital camera in the field and upload photos to the website later. If you are observing in an area where internet access is likely to be unreliable, a digital camera may be preferred.

Please ensure that:

- **The photos you upload were taken by you or your students.** Students may be tempted to upload a photo from the Internet, especially if they were unable to take a clear photo of what they observed. This is a violation of copyright law, and because the organism pictured is not the specific organism observed, the observation will not be accepted.
- **The subject of photographs is obvious.** Make sure the organism you are observing is central and clear. Try to avoid including other species in the photo if possible.
- **There are no faces in any photographs.** Hands and feet in photographs are fine.



Please avoid duplicate observations! Remember, the point is to document as many different species as possible. If many students observe the same organism or many individuals of the same species within a 100-ft radius, combine these into a single observation.

Recording Data

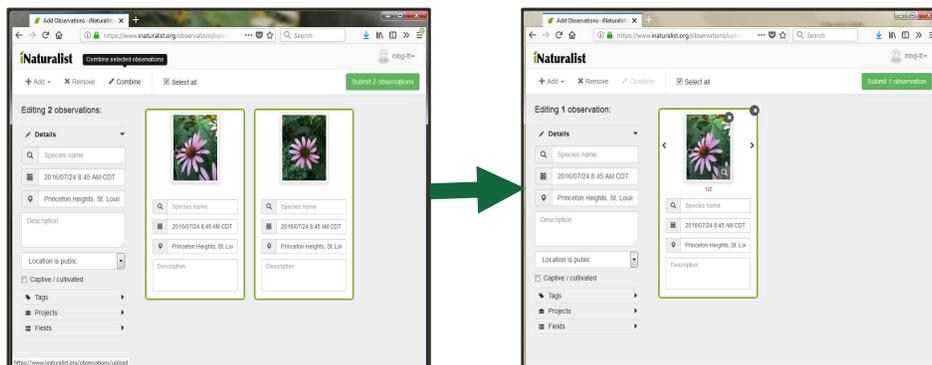
Observations include four key pieces of information in addition to photographs and/or audio files:

1. Where the organism was seen or heard (GPS coordinates)
2. When the organism encounter took place (time and date)
3. Whether the organism is captive/cultivated (cared for by humans)

If you are working in the iNaturalist app on a device that is connected to the internet, the app will automatically populate the location and time based if this information is provided by the photo's EXIF data.

If you are using a digital camera, you will need to record your data in the field. An observation data sheet has been provided in the back of this guide that may help! When back at a computer, simply upload your photos and data to the iNaturalist website:

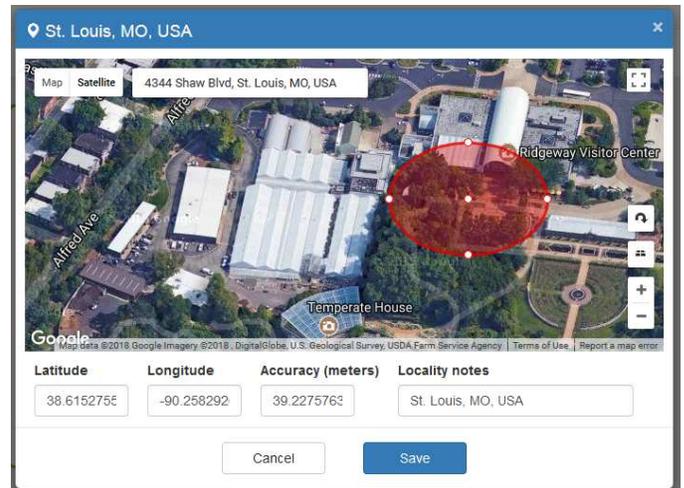
1. Click on your username in the upper right-hand corner of the screen and select Observations→Add.
2. On the observations page, click 'Add' in the upper left and select 'Upload photos or sound files'. Click 'Photos or sounds' to open a dialog box and navigate to and select the file you want to upload. (*Note that 'Observations without media' is an option in iNaturalist, but observations without media will not be counted toward the City Nature Challenge.*)
3. If you want to include more than one photo or media file in a given observation (highly recommended), repeat step 2 to add the additional files. Hold down the shift key and click on all photos to highlight them in green as shown in the following screenshot. The option to 'Combine' will appear in the top menu; click this to merge the records into a single observation. Complete the 'Details' fields on the left-side of the page that are not automatically filled with data from your photos or sound files.





If your media files do not include GPS coordinates, click the 'Location' field to call up a map. Enter the nearest address in the search bar to zoom in on the area. Then switch to 'Satellite' view and click-drag the red circle to reposition it so that the center rests as close to where the observation was taken as possible. Click 'Save'. The GPS coordinates will be added to your observation.

Observation locations can be set 'Open', 'Obscured', or 'Private'. These settings describe what other iNaturalist users can see when they view this observation. 'Obscured' locations will show the general area in which the organism was observed, which is appropriate for any organism that is threatened or endangered. Observations marked 'Private' will not show the location to other users at all.



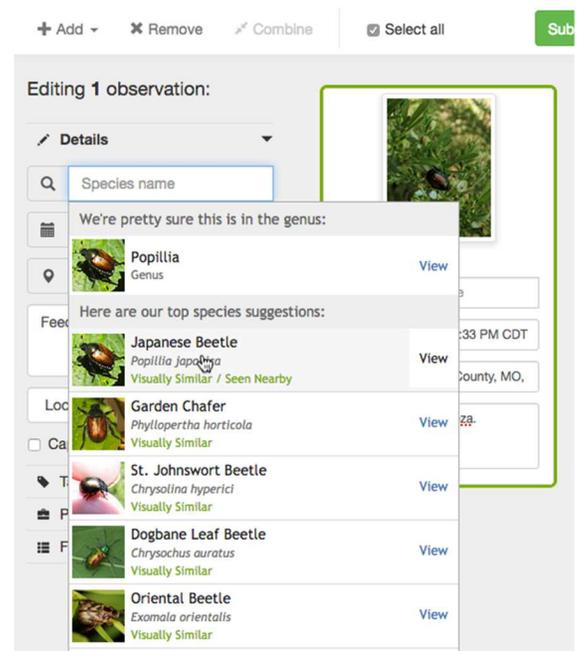
Identification of Observed Species

Identifying what you observed can be daunting, especially for students (and teachers) who are not well acquainted with the plant and animal species common to their area. This is not unusual; so if you fall into this category, **don't worry!** Provided your photos met the criteria listed above, the iNaturalist website will attempt to analyze the photo and offer suggestions.

Click 'Species Name' under 'Details'. If the iNaturalist AI is able to decipher enough information from your photo to suggest possible IDs, a menu of suggestions for you to consider will appear. Click 'view' to get a closer look at the suggested organisms, and then select the entry that best matches what you observed.

There will be times when iNaturalist cannot identify the organism in the photos or produces matches that are clearly in error. In such cases, you can select a higher level of taxonomy for the time being, such as the Order or Family, and let the iNaturalist community refine your ID later.

Note, however, that this is an excellent opportunity to engage students in the references used by professionals to identify organisms, including field guides and dichotomous keys.





You might find these web-based resources helpful:



Missouri Department of Conservation – Field Guide

nature.mdc.mo.gov/discover-nature/field-guide/search

A great starting place for all major organism groups that can be found in our area, including: trees, wildflowers, grasses, mushrooms, insects, birds, reptiles, amphibians, mammals and fish.

UNIVERSITY OF MISSOURI
Extension



University of Missouri Extension – Weed ID

weedid.missouri.edu

Another great resource for identifying common yard, field and roadside weeds found growing in Missouri.

The **Cornell Lab** 

The Cornell Lab - Merlin Bird ID

merlin.allaboutbirds.org

Merlin[®]

The Cornell Lab offers a variety of resources for observing and identifying birds, including several citizen science opportunities. The Merlin site and app are great tools to aid in identification.



**Arbor Day
Foundation**

The Arbor Day Foundation – What Tree is That?

www.arborday.org/trees/index-identification.cfm

The Arbor Day Foundation offers this beautifully illustrated dichotomous key to aid in identifying trees. Not all Missouri trees are represented here, but enough are to bring you close to an accurate ID.



Insect Identification for the Casual Observer

www.insectidentification.org

This site offers some solid help in identifying insects, as well as spiders and other arachnids.

Remember - it's okay to get it 'wrong'. Identifying species seen in the wild is challenging even for experts! The iNaturalist community was set up to enable users to cross-check identifications, so don't let anxiety over misidentification concern you or your students.



Submitting Observations to the St. Louis City Nature Challenge

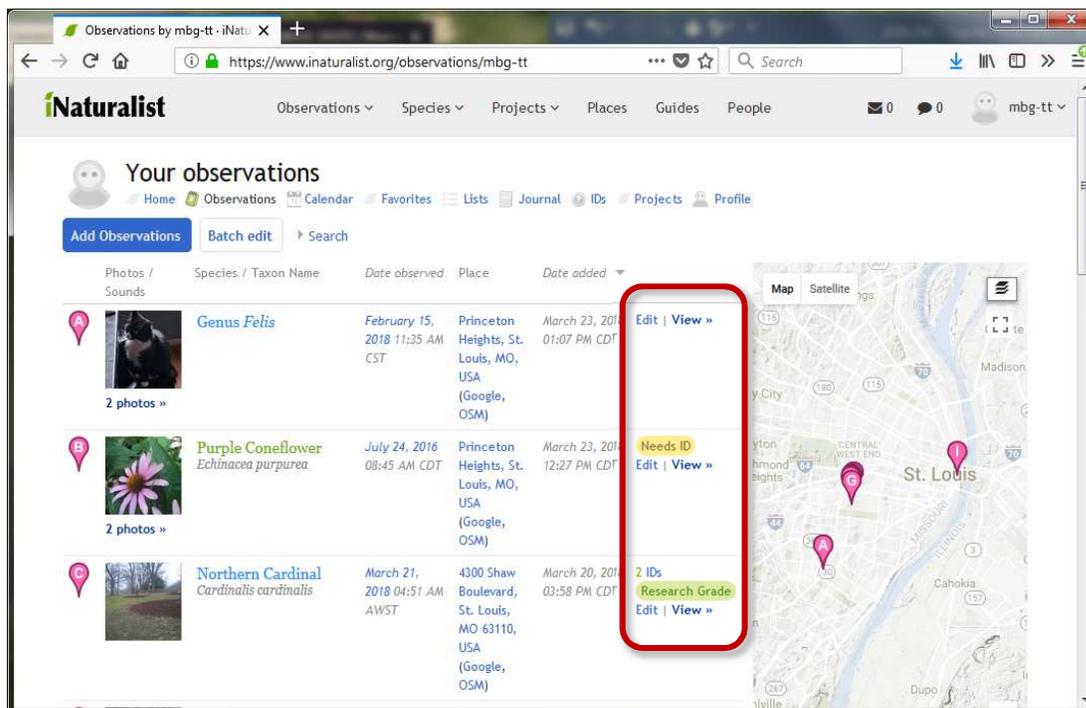
As long as you create and upload your observation during the City Nature Challenge observation days, it will automatically be included in the CNC and BiomeSTL projects in iNaturalist. iNaturalist automatically includes all observations in the combined statistical area into the CNC count, as long as they meet the criteria described earlier. There is no need to ‘join’ either project, though you are welcome to do so if you want to receive updates from the news feed for either.

Next Steps...

By Day 6 of the City Nature Challenge, you will want to make sure any and all observations submitted by your students are entered into iNaturalist and, where possible, identified.

Once complete, the following may happen:

1. A data quality ‘grade’ will be assigned to the observation.



The grade will be one of the following:

- a. **Casual** - All observations are assigned the ‘Casual’ grade when they are first created. This grade does not appear in the observation list, but can be seen on the observation itself as a gray flag. A ‘casual’ grade means one of the following:
 - i. The observation is new.
 - ii. The observation lacks media files or other important information.



- iii. The observation describes an inappropriate organism (i.e. a pet or a houseplant), or the photos of the organism are in some way inappropriate (i.e. subject isn't obvious, too blurry for ID, etc.)
 - b. **Needs ID** - An observation is bumped up to 'Needs ID' grade when all needed information is present and photos/media files are approved. Other users and iNaturalist experts will be able review your proposed identification and supply their own.
 - c. **Research Grade** - When 2/3rds of the users who review an observation agree on its ID down to the species level, the observation is assigned a 'Research Grade' status. The observation will then be eligible for referencing for scientific purposes, including creating range maps, generating ATBI lists, etc.
2. **Other iNaturalist users and experts may 'follow' you and/or comment on your observation.** As previously noted, iNaturalist is both a recording tool and a social network designed to facilitate cooperation between users in the effort to identify and catalog species observed in the wild. Other users may post comments to or ask questions about your observations in addition to providing their own identification suggestions. Users may also 'follow' your account so they can be notified when you add more observations that might be of interest to them.
3. **We'll keep you posted!** When we hear how St. Louis' CNC contributions compared with those of other cities, will post the results to the project website. Wherever we rank in the final standings, though, your students' contributions to the City Nature Challenge and to iNaturalist itself will help local scientists and policymakers learn more about the wildlife that lives around us!





iNaturalist in the Classroom

While the City Nature Challenge is a great opportunity to introduce students to iNaturalist and citizen science, we hope you'll consider incorporating the app and website into your work with students throughout the year.

The iNaturalist [Guide for Teachers](http://www.inaturalist.org/pages/teacher's+guide) (www.inaturalist.org/pages/teacher's+guide) includes a list of lesson plans and instruction suggestion that can help you get started. We also suggest the following:

Aligning with Standards

Using iNaturalist with students supports their achievement of the following performance expectations as outlined in the Next Generation Science Standards:

Elementary

- **K-ESS2-2** Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
- **K-ESS3-1 Earth and Human Activity** Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.
- **2-LS4-1 Biological Evolution: Unity and Diversity** Make observations of plants and animals to compare the diversity of life in different habitats.¹
- **3-LS4-3 Biological Evolution: Unity and Diversity** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- **3-LS4-4 Biological Evolution: Unity and Diversity** Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Middle School

- **MS-ESS3-3 Earth and Human Activity** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- **MS-ESS3-4 Earth and Human Activity** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.²
- **MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- **MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- **MS-LS2-4 Ecosystems: Interactions, Energy, and Dynamics** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- **MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics** Evaluate competing design solutions for maintaining biodiversity and ecosystem services.²

¹ This performance expectation is not included in the Missouri Learning Standards for Science.

² This performance expectation is modified in the Missouri Learning Standards for Science



High School

- **HS-ESS3-3 Earth and Human Activity** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.
- **HS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics** Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.³
- **HS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics** Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.⁴
- **HS-LS2-6 Ecosystems: Interactions, Energy, and Dynamics** Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- **HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*
- **HS-LS4-5 Biological Evolution: Unity and Diversity** Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
- **HS-LS4-6 Biological Evolution: Unity and Diversity** Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

Suggested Activities

The iNaturalist [Guide for Teachers](http://www.inaturalist.org/pages/teacher's+guide) (www.inaturalist.org/pages/teacher's+guide) includes a list of lesson plans and instruction suggestion that can help you get started. We also suggest the following:

- **Create and maintain a Local ATBI**
Any user in iNaturalist can create a Project. Teachers might consider creating a project that can be an ongoing biodiversity inventory for the schoolyard or another easily observable green space nearby. Taking students out throughout the year to collect observations will create a body of data you can then evaluate to look for patterns from year to year, determine microclimate zones within the space you're observing, and contribute to any development plans your community might undertake in the future.
- **Create and maintain a Local Field Guide**
As your students become more adept at identifying species that appear regularly in your school community, work together to create a field guide that can help others around you identify what organisms they might see. iNaturalist offers a 'guide' option on their website that can help you autopopulate an online guide based on your observations, but these will use stock photography. If you'd like to use your own students' photos instead, consider letting them decide how to lay out the pages and create it in-house.

³ This performance expectation is modified in the Missouri Learning Standards for Science

⁴ This performance expectation is not included in the Missouri Learning Standards for Science.



- **Track Local Phenology**

Phenology refers to the branch of science that tracks biophenomena: patterns of living things over time. Phenologists record observations frequently over the course of a growing season, making note of what plants are leafing out, blooming, losing leaves, or going dormant. Similarly, phenologists track migration patterns and seasonal appearances of various types of insects and animals. There are several citizen science projects available that can specifically guide you through phenological tracking methods. See the **Resources** section under 'Citizen Science' for suggestions.



Resources

Outdoor Learning Strategies

- **CNC - Tips for Teaching Outside**
education.eol.org/cnc_materials/TipsForTeachingOutside.pdf
- **Pacific Education Institute - Fostering Outdoor Observation Skills**
pacificeducationinstitute.org/wp-content/uploads/2017/03/Fostering-Outdoor-Observation_Guide.pdf

CNC Age/Grade Level 'Base Camps' for Teachers

The following documents were curated to include NGSS-aligned activities for each age/grade level.

- **Educator Basecamp for Ages 5-8 (Grades K-2)**
https://education.eol.org/cnc_materials/EducatorBasecamp_5-8.pdf
- **Educator Basecamp for Ages 8-11 (Grades 3-5)**
https://education.eol.org/cnc_materials/EducatorBasecamp_8-11.pdf
- **Educator Basecamp for Ages 11-14 (Grades 6-8)**
https://education.eol.org/cnc_materials/EducatorBasecamp_11-14.pdf
- **Educator Basecamp for Ages 14-18 (Grades 9-12)**
https://education.eol.org/cnc_materials/EducatorBasecamp_14-18.pdf
- **Educator Basecamp for Higher Education**
https://education.eol.org/cnc_materials/EducatorBasecamp_Undergrad.pdf
- **Educator Basecamp for the General Public**
https://education.eol.org/cnc_materials/EducatorBasecamp_generalpublic.pdf

Local institutions

- **City of St. Louis**
 - **City Urban Ecology Website** - www.stlouis-mo.gov/uve
 - **Sustainability in the City** - www.stlouis-mo.gov/sustainability/
- **Missouri Botanical Garden**
 - **General** - www.missouribotanicalgarden.org, 314-577-5100
 - **Education/Teacher Programs** - www.mobot.org/schoolprograms, 314-577-0185
 - **BiodiverseCity St. Louis** - www.mobot.org/biodiversecitySTL
- **Saint Louis Zoo**



- General - www.stlzoo.org, (314) 781-0900
- Education - www.stlzoo.org/education/forteachers/, (314) 646-4544
- **Academy of Science - STL**
 - General - www.academyofsciencestl.org, (314) 533-8083
 - For Educators - www.academyofsciencestl.org/educators/
- **Missouri Department of Conservation**
 - General - mdc.mo.gov
 - Discover Nature Schools - nature.mdc.mo.gov/discover-nature/teacher-portal

Field Guides

- **Golden Guides, St. Martin's Press**
us.macmillan.com/series/agoldenguidefromstmartinspress/
- **Peterson Field Guides**
www.houghtonmifflinbooks.com/peterson/
- **Sibley Guides**
www.sibleyguides.com
- **Audubon Society Field Guides**
www.audubon.org/national-audubon-society-field-guides
- **Missouri Department of Conservation**
www.mdcnatureshop.com

Species Identification

- **Missouri Department of Conservation - Field Guide**
nature.mdc.mo.gov/discover-nature/field-guide/search
- **University of Missouri Extension - Weed ID**
weedid.missouri.edu
- **The Cornell Lab - Merlin Bird ID**
merlin.allaboutbirds.org
- **The Arbor Day Foundation - What Tree is That?**
www.arborday.org/trees/index-identification.cfm
- **Insect Identification for the Casual Observer**
www.insectidentification.org



Citizen Science Opportunities

ATBI

- [iNaturalist](http://www.inaturalist.org) - www.inaturalist.org
- [Project Noah](http://www.projectnoah.org) - www.projectnoah.org

Population Tracking

- [Frogwatch \(AZA\)](http://www.aza.org/frogwatch) -- www.aza.org/frogwatch
- [Feederwatch \(Cornell\)](http://feederwatch.org) -- feederwatch.org
- [Lost Ladybug Project](http://www.lostladybug.org) -- www.lostladybug.org
- [MonarchWatch](http://www.monarchwatch.org) -- www.monarchwatch.org
- [Firefly Watch \(MOS\)](http://legacy.mos.org/fireflywatch) -- legacy.mos.org/fireflywatch

Phenology

- [Nature's Notebook \(USAPN\)](http://www.usanpn.org/natures_notebook) -- www.usanpn.org/natures_notebook
- [Project Budburst \(Chicago Botanic\)](http://budburst.org) -- budburst.org
- [Journey North](http://www.learner.org/jnorth/) -- www.learner.org/jnorth/
- [Picture Post \(UNH\)](http://picturepost.unh.edu) -- picturepost.unh.edu

Miscellaneous/Other

- [CoCoRaHS \(Weather Tracking\)](http://www.cocorahs.org) -- www.cocorahs.org
- [Globe at Night \(Ambient Light Tracking\)](http://www.globeatnight.org) -- www.globeatnight.org

Observation Data Sheet

St. Louis City Nature Challenge

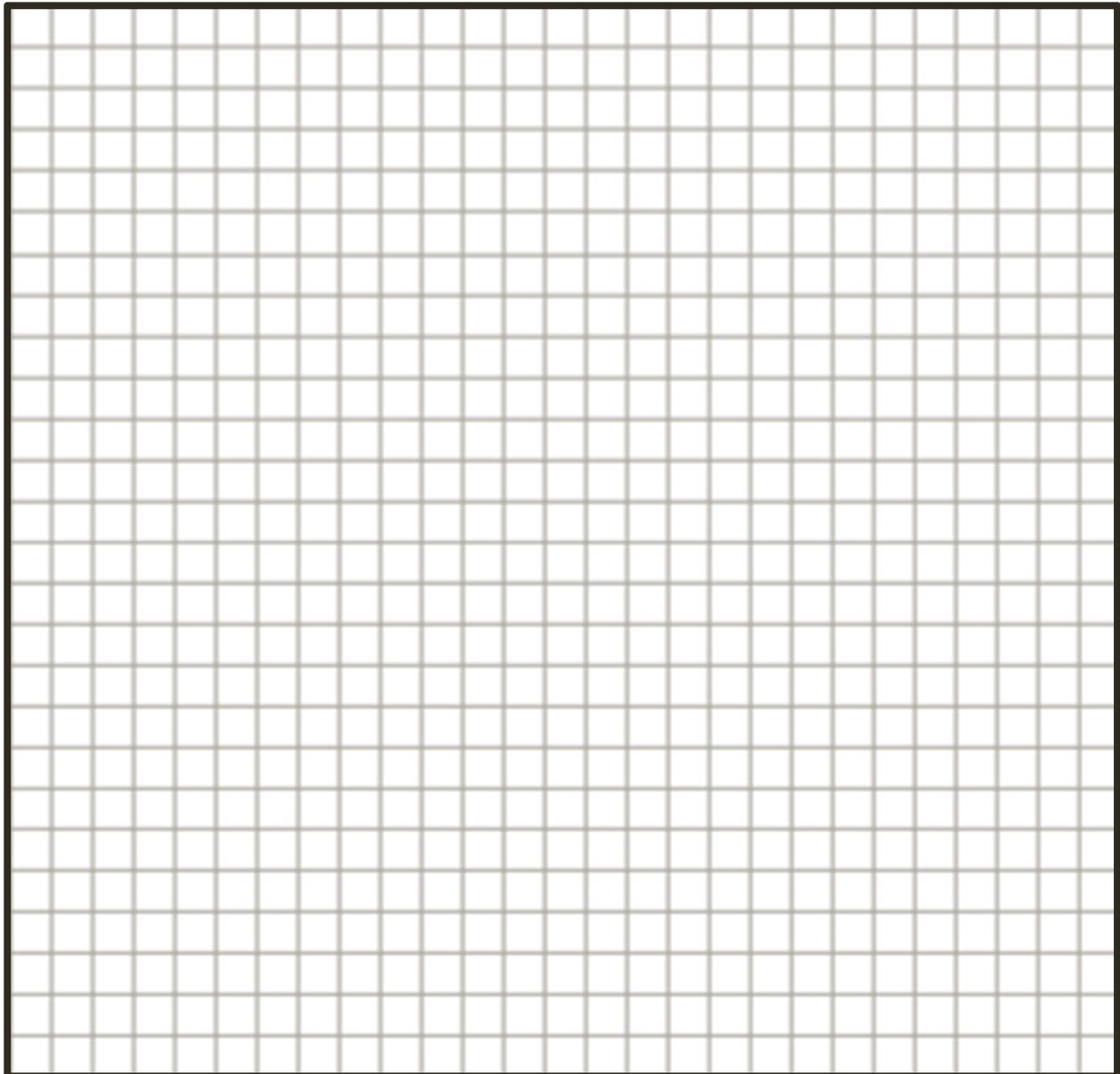
Observer

Name _____ Date _____ Class _____

Location

Address _____ City: _____ State _____ ZIP _____

Sketch the general layout of the site below, including landmarks such as buildings, surrounding streets, utility poles, etc.



EXAMPIE

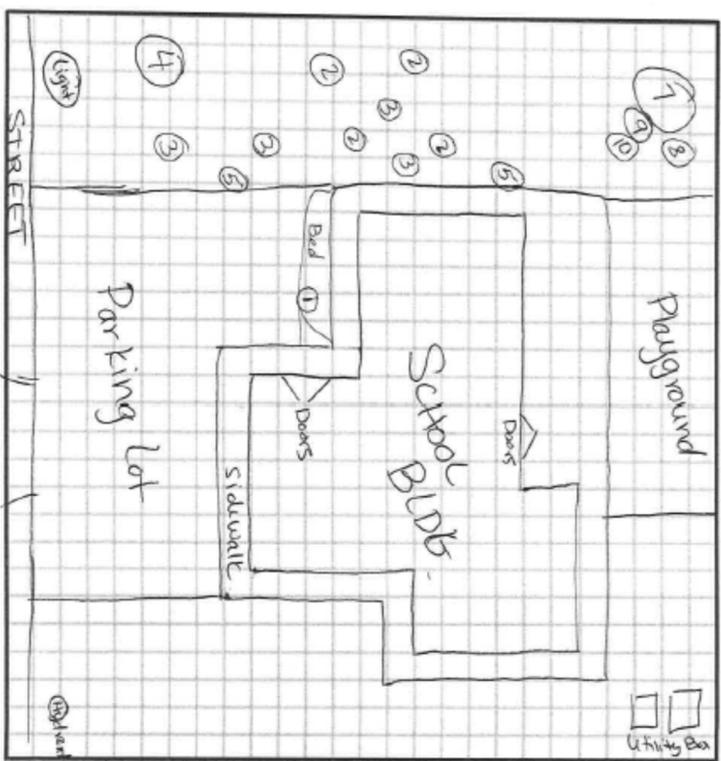
Observation Data Sheet

St. Louis City Nature Challenge - 2018

Observer Joe Student Date 4/27/18 class Ms. Smith

Location Address 1234 School St. city: St. Louis state MO ZIP 63110

Sketch the general layout of the site below, including landmarks such as buildings, surrounding streets, utility poles, etc.



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Name Joe Student

Organisms Observed

Record your observations in the table below. Mark the number of each observation on the diagram above to indicate where it was located.

#	Time	Type (i.e. -Tree, Bird, Mammal, etc.)	Description	# of Photos
1	9:35am	Robin (Bird)	Feeding by Front doors	2
2	9:35	Plant Plant	Dandelion (many)	4
3	9:40	Plant	Clover (many)	4
4	9:42	Plant (Tree)	Maple	4
5	9:45	Plant	Wood sorrel (Yellow flowers?)	3
6	9:50	Plant	Not sure - Flat plant, blue flowers (small)	3
7	9:52	Plant (Tree)	Pine?	4
8	9:53	Bird	Cardinal	1
9	9:55	Insect	Cricket (Under Rock)	2
10	9:58	Insect?	Millipede (Under Rock)	2

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