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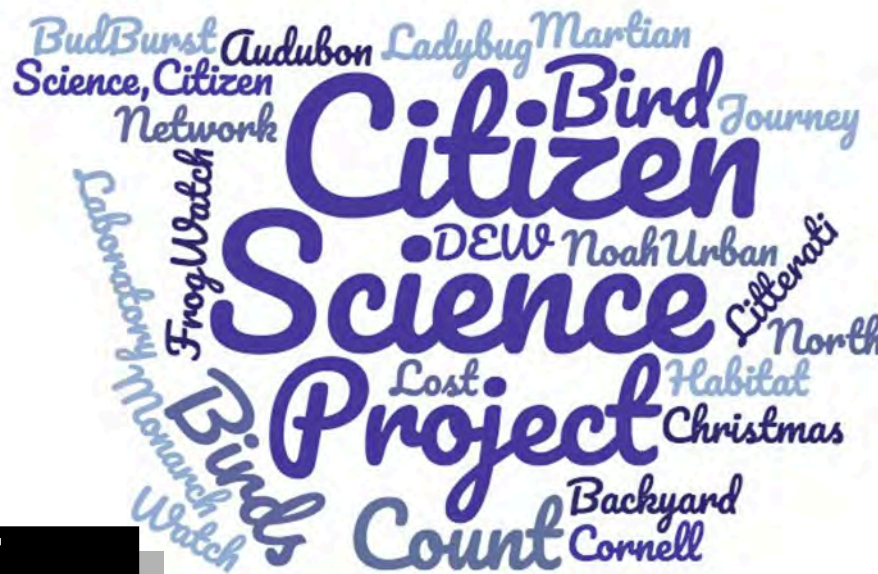
Teaching Resource Activities and Conservation to Kansas Students



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**Don't Miss
Our Next
Issue:**

**Children and
Nature**

Citizen Science

The Oxford English Dictionary defines citizen science as "scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions." Citizen scientist is defined as: (a) "a scientist whose work is characterized by a sense of responsibility to serve the best interests of the wider community"; or (b) "a member of the general public who engages in scientific work, often in collaboration with or under the direction of professional scientists and scientific institutions; an amateur scientist." Citizen science is sometimes described as "public participation in scientific research," participatory monitoring and participatory action research.

Citizen science is not really a new thing. People have been observing and recording their observations about the natural world for thousands of years. Some of the more extreme record-keeping to come to light, shows that winegrowers in France have been recording grape harvest days for more than 640 years and court diarists in Kyoto, Japan, have been recording dates of the traditional cherry blossom festival for 1200 years. China has records dating back at least 3500 years tracking outbreaks of locusts. In the U.S., the longest continuous observations are related to agriculture and records track the timing of sowing, harvest, and pest outbreaks.

Science wasn't really considered a profession until sometime in the late 19th century. Before this time, those making observations or keeping track of daily and yearly cycles were really doing this as a "hobby". Being a hobby didn't mean that the work was less scientific and many an "amateur" scientist was truly an expert in their area of study. As science began to be recognized as a profession, "amateur" scientists began to be marginalized and "professional" scientists took on the role of researcher. Nature clubs (like Audubon Society) continued to serve as a place for those interested in natural history observations to find like-minded individuals but the nature of scientific inquiry had

changed. Today, it is much harder for "amateur" scientists (people who make their living in other ways but spend their free time performing research) to report their findings in respected journals, and, therefore, to advance in their fields.

Citizen science has two roles in modern research. First, to facilitate large-scale and/or geographically diverse projects. Take the Breeding Bird Survey (BBS) for example, which provides ornithologists with a huge dataset of nesting activities in both the U.S. and Canada. Scientists would be hard-pressed to come up with the manpower, not to mention the finances, to collect the amount of information generated by the BBS volunteers. Secondly, citizen science can undertake projects that professionals would (or could) not ordinarily do on their own. Take the "Save our Streams" project which began in Maryland but has been duplicated across many states. Save Our Streams is an effort to monitor, protect, and restore streams by teaching people to check water quality in local creeks to get a clear picture of water quality across the country – the first step in crafting water quality solutions that work.

With improved technology and advances in communication, citizen science has great potential to engage the public in research projects, improve scientific literacy and interest in science and educate participants on the species or habitats they are studying.



Science for the Birds

Without a doubt, Cornell Lab of Ornithology is a leader in citizen science projects. According to their website, “hundreds of thousands of people around the world contribute bird observations to the Cornell Lab each year, gathering data on a scale once unimaginable. Scientists use these data to determine how birds are affected by habitat loss, pollution, disease, and climate change. They trace bird migration and document long-term changes in bird numbers, creating species-specific conservation plans and targeted action to help birds find the resources they need to survive.”

There are 6 notable citizen science projects hosted by the Lab of Ornithology (www.birds.cornell.edu).

rence, abundance and distribution on a worldwide basis.

Quick Facts

- At least 150 scientific papers have used Cornell Lab citizen-science data since 1997.
- More than 300,000 nesting attempts reported to the Cornell Lab since 1997.
- More than 7.5 million bird observations reported to eBird on average each month.

This service is available at no cost, but participants do need to sign up with an account found at:

www.ebird.org Birders enter the information on their observations on a pop-up checklist, tailored for their particular locations. They are viewable on a map, based on precise locations that are pinpointed easily within the system. There are filters in place that will flag any observations deemed unusual and reviewers with expertise in the region can correspond with participants to obtain more details on a particular record. Data from eBird submissions are stored in a secured facility,

archived daily and are available to access by anyone via the eBird website. It is a fun and easy to not only keep track of your personal observations, but also find other locations where birding is good, locate areas that might host birds of interest to you and provide others details of what you have observed that may be of interest to them as well. Data collected in other type of citizen science activities for birds can be entered into this database as well, providing even more access to valuable information. Use of eBird is helping to contribute to an increased understanding of the distribution, richness, and uniqueness of the avian biodiversity of the planet.



1. eBird

The eBird online checklist program was launched in 2002 by the Cornell Lab of Ornithology and the National Audubon Society. Using eBird is easy, fun and continues to gain popularity. It provides real-time access to a wealth of information on bird abundance, occurrence and species location information, and also provides a way for birders to enter and track their data for life lists, country, state & county lists and much more. It is one of the fastest growing biodiversity data resources locations, with thousands of users and millions of observation entries worldwide.

Observations of each participant are available to a global community of ornithologists, education specialists, land managers and others that help lay the foundation for a better understanding of bird occur-

2. Project Feeder Watch

This citizen science project has people observe bird feeders and record their findings. The observation period runs from November to April but participants choose the dates they wish to observe and decide how



long they are going to watch. This data enables scientists to monitor changes in the distribution and abundance of birds across the United States including studying the influence of non-native species on native bird communities, examining the association between birds and habitats, and tracking unpredictable movements in winter bird populations. The website has all the information you could need to determine what type of feeder you might like, what types of food are best and where to place your feeder. There are aids for identifying birds, even the tricky ones that are similar to other birds, and every other question you might have about counting the birds. Entering your data is easy as well so this is a perfect project for teachers who have access to a view from a window!



3. NestWatch

Similar to Feeder Watch, NestWatch participants help scientists track the breeding success of birds across North America by collecting information about nest location, habitat, bird species, number of eggs, and number of young. Launched in 2007 with funding from the National Science Foundation, NestWatch is building an unmatched database which, combined with historic data, is helping scientists understand how breeding birds are affected climate change, urbanization, and land use. NestWatch participants must become certified to participate in this program. Nest monitoring protocols, identification of nests and nestlings and a code of conduct are all integral to this certification but everything is explained thoroughly on the website.



4. Celebrate Urban Birds

Celebrate Urban Birds is a bilingual project focused on underserved urban and rural communities. Participants watch for 10 minutes and report on the presence or absence of 16 species of birds. The project also assesses the value of green

spaces for birds. Celebrate Urban Birds partners with thousands of community groups to distribute educational kits in English and Spanish, and to support local bird, habitat, and art events with mini-grants.



5. Great Backyard Bird Count

The four-day Great Backyard Bird Count (GBBC) is a global event, integrated with the eBird online checklist program. Bird watchers of all skill levels are welcome. Participants submit observations from more than 120 countries documenting more than half the world's species. The count is a joint project of the Cornell Lab and Audubon with Canadian partner, Bird Studies Canada and was launched in 1998. The Great Backyard Bird Count was the first online citizen-science project to collect data on wild birds and to display results in near real-time.

Now, more than 160,000 people of all ages and walks of life worldwide join the four-day count each February to create an annual snapshot of the distribution and abundance of birds. It only takes 15 minutes of your time on one or more days of the count (February 16-19, 2018) to simply tally the numbers and kinds of birds you see. You can count from any location, anywhere in the world, for as long as you wish!



6. Habitat Network

Habitat Network is a community of people interested in creating wildlife-friendly habitat in the places we live and work. Participants map their property, explore how collective efforts to transform yards and

urban landscapes into more diverse habitat may support wildlife, and connect with others seeking to make room for the natural world within residential areas. The Habitat Network is a joint project of the Cornell Lab and The Nature Conservancy.



Christmas Bird Counts



Have you ever heard of a Christmas bird count? The idea of a Christmas bird count was spawned from a practice prior to the turn of the 20th century by hunters called a Christmas “Side Hunt”. Groups of hunters would choose sides, go afield and whatever team brought back the most birds and mammals won the contest. Many scientists and wildlife watchers in that era become concerned with a decline in species. An ornithologist named Frank Chapman from the American Museum of Natural History proposed a new holiday tradition: a “Christmas Bird Census” where participants observed and counted birds, rather than hunt them. December 25th, 1900 became the first Christmas Bird Count, with 27 participants counting in 25 different locations across the country.



From those humble beginnings, the official Audubon Christmas Bird Counts of today have expanded to consist of a twenty day period from December 14th to January 5th every year, with tens of thousands of participants on hundreds of counts helping in the collection of data used for a variety of bird population trend studies and helping to guide conservation efforts for many species of concern. The data collected over the decades of counts allow a variety of different researchers, wildlife agency personnel and other interested observers study the long-term health and status of bird populations across the continent and beyond. This long-term perspective is extremely important in helping make informed strategies on best ways to protect birds and their habitat and identify potential environmental issues that could impact humans as well.

Rules for Christmas bird counts are fairly simple, with each count area consisting of a circle, 15 miles in diameter with a known, marked center point. This remains constant from year to year, with the count taking place on a single 24-hour calendar day. There is no set number of participants needed, but usually the more observers out and counting, the better cover-

age a circle can get. All bird species are tallied and numbers of individuals of each species are kept track of as well. Official forms are obtained from the National Audubon Society and reports from each count are submitted to the national office after counts are conducted. Participants need to have a

good working knowledge of species possible to see in a particular area, but it is a great way to start beginning birders if they can go out with someone more experienced to act as mentors. The hours spent in the field by individuals or groups, number of miles walked and driven, and effort put in by those doing nocturnal counts and

only watching bird feeders are all recorded and submitted as part of the overall data set.

Kansas averages around 50+ CBCs each year, with not all of them submitted to National Audubon for inclusion into the national database for a variety of reasons. Some fall just outside the allowed time frame, while others may just have a single observer or not survey a complete circle. This data from all Kansas counts is collected and printed in the Bulletin of the Kansas Ornithological Society (KOS), including those submitted to Audubon. Total observer numbers can vary from a single person to upwards of 75 in some locations. Species counts obviously vary from year-to-year, depending on weather conditions, number and skill of participants and other factors.

The total number of observers statewide usually averages between 500-600 people, with total number of species averaging around 160 overall. High species counts for a single circle can reach around 100, but usually average somewhat less than that (around 75 species). The data collected is summarized, published and available to members of KOS as a mailing or can be accessed on the website for the organization: www.ksbirds.org with a lag of a year or two. These counts are a fun way to contribute to a long-running method of data collection in a tried-and-true citizen’s science endeavor.



Audubon's Climate Watch Program

In 2014, Audubon released a document called the Audubon Birds and Climate Change Report. This report underlined risks that climate change poses to over half of the bird species found across North America. The Audubon Climate Watch bird survey was created as a tool to help us learn how birds are responding to climate change. For instance, climate change may create less suitable nesting habitat for a species and cause a drop in its population.

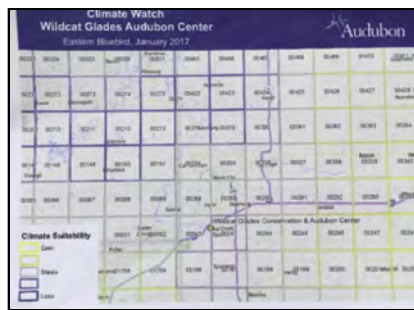
The Climate Watch Pilot launched in 2016, with several Audubon chapters across North America participating. The plan is for two surveys to take place each year; one from January 15-30, and another from June 1-15. To start the pilot off, Audubon selected bluebirds (Eastern, Mountain, and Western) as the focus of their first surveys in 2016. Bluebirds are easy to identify, and through Audubon's climate models, they offer strong predictions for range shifts.



Eastern Bluebird at a bluebird nest box.

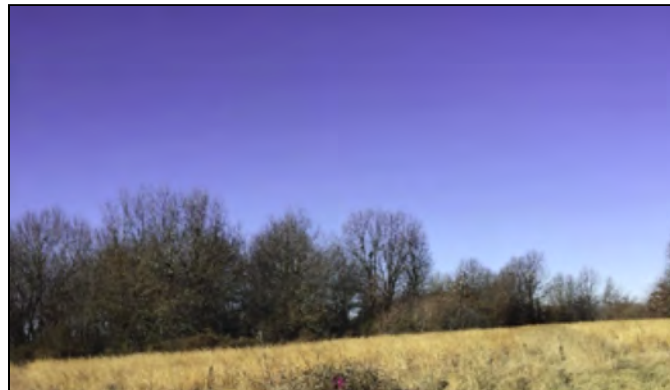
The pilot focused on areas of predicted change for bluebirds within each pilot chapter's territory. Each Audubon chapter's territory was then broken up into 10km x 10km squares on maps, in which volunteers conducted 12 point-count surveys.

In January 2017, Wildcat Glades Audubon Center participated in the program and recruited volunteers to conduct surveys in southeast Kansas and southwest Missouri. This area focused on Eastern Bluebirds, but Audubon chapters in other parts of the nation also added nuthatch species as their target birds for the survey.



Survey squares. Map by Audubon.

First, volunteers for the Wildcat Glades survey area chose a survey square. Squares with predictions of a loss in suitable habitat or a gain in suitable habitat were preferred over squares that predicted no significant changes. Once the square was picked, the volunteer would then go out and pick 12 survey points inside the 10km x 10km square that exhibited typical Eastern Bluebird habitat and marked the locations with GPS. These survey points become the locations used for the winter and summer surveys every year.



Example of bluebird habitat at a point count location.

After the locations were chosen, the volunteer then went out to the locations during morning hours within the timeframe (Jan. 15-30) allotted to conduct the survey. At each location stop, the volunteer stood outside, counting and recording all bird species seen and heard for a period of 5 minutes, then moved onto the next location. This is very similar to the method used for Breeding Bird Surveys. All data collected was then submitted to the Climate Watch support team.

For more information about the Climate Watch program or if you are interested in participating in future surveys, check out Audubon's website:

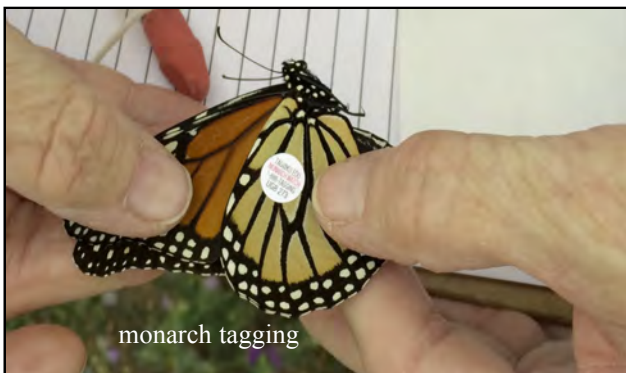
www.audubon.org/news/climate-watch-program

Fly into Citizen Science with Monarch Butterflies

The Kansas Wetlands Education Center has provided our fourth grade students with the opportunity to participate in the tagging of monarch butterflies each fall. This is a wonderful experience for our students to have a hands-on science activity in order to understand the importance that monarchs play in our ecosystem. The education specialist provides background information on the monarch, its life cycle, feeding habits, adaptations, migration patterns, and its role in pollination. She showed them the proper way to catch and release the butterfly without harming it. Afterwards each child is given a net to try and catch monarch butterflies. Some years we are more successful than others, it just depends on the wind and weather. She shows the students how to hold, put a numbered sticker on its wing, and how to safely release it back into the wild. Each tag has its own unique number which is recorded. When the monarch reaches its final destination, Mexico, scientists read the tags and notify personal at the tagging location to let them know if the monarch has completed its migration. She lets us know if any of our butterflies completed the journey. The students enjoy the opportunity to take part in this annual event.

Laurie Feist and Annette Cain, fourth grade teachers

How do you tag a monarch butterfly?
Very carefully.



Actually, the tagging process is easy enough for grade school age students to conduct. For the past 25 years, thousands of school children (and adults) have headed out into fields and gardens in early fall to catch and tag monarch butterflies through Monarch Watch, a citizen science program established for education, research and conservation of monarch butterflies

Every year, hundreds of millions of monarch butterflies from eastern Canada and the U. S., undertake a fall migration of over 2,000 miles to overwintering sites in Central Mexico. Scientists have been trying to understand how the migrating monarchs, which are three to four generations removed from those that made the journey the year before, find their way.

The supplies needed to participate in this scientific endeavor are few: Tags, data sheets, clipboards, pencils, envelopes and nets. Monarch Watch provides tagging kits, including tags, a data sheet and instructions on handling and tagging the butterflies. Tagging sheets contain 25 tags and may be purchased singly or in multiples of 100. Each tag has its own unique code consisting of three letters and three numbers and contains the Monarch Watch phone number and website for tag returns. If your school does not have nets, good sources for borrowing nets are local universities, county extension departments and crop consultants. A good source to purchase sturdy, inexpensive student nets is BioQuip, or you can make your own nets. There are lots of online sources for instructions but the net opening should be 12 inches or more and at least 24 inches deep.

For those in urban situations, monarch caterpillars may be purchased from Monarch Watch (www.monarchwatch.org) to raise in the classroom. The resulting adult butterflies may then be tagged and released.



Participants record the butterfly's tag number, date, sex, whether it is a wild-caught or raised butterfly, and tagging location. Fortunately, it is a simple process to determine a monarch's sex. The males have a black



scent gland located in the middle of the inside, rear wing, which is lacking on the female. The females also have much thicker black veins.



Tagging does not begin until late August and continues through September and in some years, into early October, depending on weather conditions. An estimate of peak migration times is available at www.monarchwatch.org/tagging.

Applying the tag to the butterfly wing, becomes second nature after you've tagged a few. The butterfly should be carefully removed from the net, with wings together. The correct way to hold the butterfly is between your index finger and thumb, with wings together, holding at the point behind the butterfly's head and thorax. This is the strongest area of the wing. If you have long nails, you may simply peel off the tag, which is the size of pencil eraser, from the self-adhesive sheet and apply it to the large mitten shaped cell in the middle of the hind wing, hold firmly between from both sides of the butterfly's wings for three seconds. If you don't have long nails, a large safety pin works well for tag removal and application. The key to success is not allowing the tag to touch your fingers or other surfaces.

After the tagging season ends, the data sheets are submitted to Monarch Watch. Tagged monarch recoveries are reported in May or June. This data is easily accessed and can be used in inquiry-based learning by comparing data collected in different years and different sites, determining ways to reduce error during data collection, finding means, modes and ranges in each series of numbers, graphing – the possibilities are endless.

Data recovered and analyzed from Monarch Watch's tagging program has helped define the timing and pace of the migration. It has also shown the probability of successfully reaching the migration grounds in Central Mexico is related to geographic location and the date of tagging.

In addition to combining science and math, additional subjects are also easily incorporated, such as geography – following the migration through different geographical areas. Students may journal their experiences and thoughts in a writing exercise or discuss the social implications of tourism and reduced logging in the overwintering sites and reducing the use of certain herbicides that kill milkweed.



Butterfly release

Students may track the monarch migration, using another Citizen Science program, Journey North. Individuals from around the U.S., submit reports of monarch sightings throughout the year in the egg, larval and adult form. During migration, the maps fill with dots indicating the migration wave. The program also tracks milkweed emergence – the food plant for monarch caterpillars.

From the physical exercise of data collection and tagging and recording observations to comparing data collected by others and analyzing their data, these user-friendly citizen science programs provide an endless array of inquiry-based projects.

A Science Mystery Solved

The monarch's migration destination was an unsolved mystery until 1975, when Ken Brugger and Catalina Aguado, citizen scientists working for Dr. Fred Uriguhart, found millions of butterflies on Cerro Pelon, located in Mexico's transvolcanic mountain belt. Dr. Uriguhart was a renowned butterfly expert from Ontario who had been searching 40 years for the monarch's destination.

Uriguhart and his wife Norah, worked many years perfecting a tagging system to track the monarch's movements. Knowing they could not tag



Fred and Norah Uriguhart

enough butterflies themselves, they enlisted volunteers to help in the effort, which continues today through Monarch Watch.

Although a site had been discovered in 1975, no tagged monarchs were found to prove monarchs east of the Rocky Mountains migrated there. So Uriguhart traveled to the area in 1976 for the first time, finding a tagged monarch 5 minutes after arriving.

Two students and their teacher had tagged the monarch in Chaska, Minn. Monarch PS 397 had traveled over 2000 miles before arriving at the site.



National Geographic photographer Bianca Lavies took this photo just minutes after Fred found the tagged Monarch (PS 397) on the ground among the millions of butterflies!



Additional Butterfly Citizen Science programs:

- **Journey North** - www.learner.org/jnorth - An online citizen science project that tracks migration, from monarch butterflies to gray whales, and seasonal change.
- **Monarch Monitoring Project** – www.monarchmonitoringproject.com – Research and education program focusing on the fall migration of monarch butterflies along the Atlantic Coast. It provides data that can be used for comparisons.
- **Project Monarch Health** – monarchparasites.org – A citizen science project in which volunteers sample wild monarch butterflies to track the spread of a protozoan parasite across North America.
- **Monarch Larval Monitoring Project** – www.mlmp.org -A citizen science project aiming to better understand how and why monarch populations vary in time and space, with a focus on distribution and abundance during the North American breeding season.
- **MonarchLab** – www.monarchlab.org/Lab - A University of Minnesota site that provides information about monarch biology, migration and conservation with rearing tips.
- **Monarch Alert** – monarchalert.calpoly.edu – A Cal Poly State University project, focusing on demography and population fluctuations of western monarch butterflies
- **NABA Fourth of July Count** – Volunteers follow specific parameters to identify and count butterfly species on one day during the month of July, focusing on tracking population trends.



FrogWatch USA



FrogWatch USA is a nationwide frog and toad monitoring citizen science program whose dataset extends back to the late 1990's. Now under the wing of the Association of Zoos and Aquariums (AZA), this network of chapter coordinators and volunteers has the common goal of providing large scale, long-term data on frogs and toads in the United States.



the natural environment, which in turn may inspire an increase in conservation and stewardship actions.

FrogWatch USA runs annually from February through August. To begin, participants adopt a wetland site, either self-selected or with the guidance of a chapter coordinator, and commit to visiting that site multiple evenings during the season. During these visits, participants record information about the weather conditions, wait at least two minutes for frogs to acclimate to the presence of a human in the wetland, and then write down the calling intensities of frog and toad species heard during a three minute listening session. Monitoring visits are encouraged to be as frequent as possible, ideally twice per week, throughout the FrogWatch USA season. Recognizing that this can be a time-heavy commitment, the importance of multiple data collection observations throughout the season is emphasized, in order to account for all species that may be present at a wetland site. Some frog and toad species only call in very early spring, while others may continue into late summer. Volunteers should monitor a minimum of four times over the course of the season, and all data is submitted to a national database.

Why Frogs?

Due to their semi-permeable skin and life histories that include time in both aquatic and terrestrial environments, frogs, toads, and other amphibians are sensitive to a variety of ecological changes that may otherwise be difficult to detect. Therefore, they can serve as indicators of environmental health. Fluctuations in their population sizes, or shifts in their ranges or the timing of their life cycles, could be indicative of other changes occurring in the ecosystem. The International Union for Conservation of Nature (IUCN) estimates that at least one-third of known amphibian species are threatened with extinction (a rate significantly higher than for bird or mammal species).

Experts Not Required

You don't have to be a frog expert to contribute. You should participate if you have:

- An interest in learning about frogs and toads
- The commitment to learn and identify their distinct calls
- The ability to make several evening visits to a local wetland for data collection from February through August.

FrogWatch USA assists volunteers in learning the calls, as well as learning about amphibians, wetlands, and interpreting changes in the environment. Volunteers may monitor by themselves, in groups, and/or with their families and may enjoy a sense of community and camaraderie through their participation. They may also establish a closer relationship with

How to Get Involved in Kansas

If you are interested in becoming a certified FrogWatch volunteer you must attend 6 hours of training. You will learn about amphibians, wetlands, data collection protocols and how to identify our local species by their call. Trainings are offered annually in the spring.

Cheyenne Bottoms FrogWatch

KS Wetlands Education Center (KWEC), Great Bend

FrogWatch of the Flint Hills

Sunset Zoo, Manhattan

Milford Nature Center, Junction City

Sedgwick County Zoo

Sedgwick County Zoo, Wichita

For more info visit:

www.aza.org/frogwatch



Digital Earth Watch (DEW) Picture Post Network



The Picture Post Network enables citizen scientists and students to measure environmental change. With a camera or smartphone, participants collect meaningful information about the well being of their community and become a part of national and global efforts to tackle environmental problems such as climate change.



Picture Post is open to anyone with a digital camera who wishes to take and share his

or her photographs from Picture Post locations. Many posts are in parks or on trails that are open to the public. Other posts are placed in backyards and schoolyards for specific projects. Regardless of whether a post is on public or private land, all pictures shared on the website can be used freely by anyone for observations, comparisons, or research. Picture Posts are valuable additions to any environmental monitoring activity including at nature centers and nature trails, botanical gardens, parks, conservation lands, outdoor classrooms, research field sites, and even your own backyard! NASA sponsors the DEW Picture Post Network, with additional support from a CI-TEAM grant from the National Science Foundation.

What Can DEW Tell Us?

DEW focuses on information that can be captured in digital photographs. Picture Post provides a standard method for using repeat digital photography to record the landscape and make measurements of environmental conditions. Plant health is a main focus of DEW and Picture Post, but many other features can be monitored such as

lake water levels, ice and snow cover, and air quality to name a few.

Pictures are available to anyone for non-commercial uses. You can download individual pictures directly from the website, or arrange to get multiple picture sets by making an email request to Picture Post Support.

From California to Connecticut, school groups, college classes, nature centers, environmental clubs, community improvement organizations, and outdoor enthusiasts are taking part in the Picture Post Network. Each of them is making a unique contribution, including:

- Biology students are documenting daily, tidal, and seasonal changes at Wells Harbor in Maine.
- The Seacoast Science Center in Rye, New Hampshire, which is tracking the dates that perennials emerge in the spring and how quickly invasive sumac takes over a cleared field.
- Graduate students at the University of Idaho, who are teaching introductory geography labs, are engaging undergraduates to record data on the timing of lifecycle stages in lilacs.
- The Guana Tolomato Matanzas National Estuarine Research Reserve in Ponte Vedra Beach, Florida, where visitors, volunteers, and students monitor sand erosion, changes in beach plant communities, wetlands restoration, conservation of oyster habitats, dredging along the Intracoastal Waterway, increasing wave action due to river traffic, and sea-level rise.

Getting Started

The Picture Post website www.picturepost.unh.edu has all of the information needed to participate in the Picture Post Network. There are written instructions and Help Videos to guide new users in getting started. You can purchase the 8-sided platform made of a recycled plastic lumber from us or follow the instructions to build your own. The Picture Post team is always available to answer questions by email. We also offer Train-the-Trainer Workshops by request for formal and informal science educators who are interested in teaching the program to community leaders and others. To get started, visit the Help Page.



Project BudBurst

Project BudBurst
Timing is everything!

Project BudBurst is a network of people across the United States who monitor plants as the seasons change as part of a national field campaign designed to engage the public in the collection of important ecological data based on the timing of leafing, flowering, and fruiting of plants (plant phenophases). Project BudBurst participants make careful observations of these plant phenophases. The data are being collected in a consistent manner across the country so that scientists can use the data to learn more about the responsiveness of individual plant species to changes in climate locally, regionally, and nationally. Thousands of people from all 50 states have participated. Project BudBurst began in 2007 in response to requests from people like you who wanted to make a meaningful contribution to understanding changes in our environment.

As a National Ecological Observatory Network (NEON) program, Project BudBurst receives its primary funding from the National Science Foundation. Project BudBurst is 100% web-based and all materials are available free of charge from the Project website:

www.projectbudburst.org

Not Just for the Spring

Phenology is literally “the science of appearance.” Scientists who study phenology – phenologists – are interested in the timing of specific biological events (such as flowering, migration, and reproduction) in relation to changes in season and climate. Seasonal changes can include variations in day length, temperature, and rain or snowfall. In short, phenologists attempt to learn more about the abiotic factors to which plants and animals respond.

The arrival of spring gets a lot of attention in terms of phenological events, with flowers emerging from their winter slumber. However, equally



important phenological events happen throughout the year. In the case of Project BudBurst, don't let our name fool you. We want to know when you first notice the signs of all seasonal change in plants, like when the leaves change color in the fall and when summer wildflowers wither and finish their life cycle. You can tell us about these changes by making observations and sharing them with us through our website. By joining Project BudBurst, you will be part of a community spanning the country that is furthering the understanding of plant phenology.

A Case Study

Dr. Kayri Havens of the Chicago Botanic Garden compared data collected in Cook County, Illinois between 1954 and 1994 to Project BudBurst data collected within the same area between 2007-2011. Her analysis demonstrates that red maple is now flowering 14 days earlier each year, on average. Similarly, all other species observed by Project BudBurst participants were found to bloom earlier when compared to the historical dataset. Worldwide, plants in temperate latitudes have been advancing their flowering times by about 2-3 days every 10 years over the past 30 years in response to warmer spring and winter weather. It appears that for this study area around Chicago, the analysis of Project BudBurst data suggests that plants are changing their timing of flowering in a dramatic way (twice the global average). This is an interesting and potentially important finding. It allows us to further understand how quickly some plants can adapt to changing conditions.

Educator Resources

If you have been looking for ways to connect current issues with your science instruction, Project BudBurst can help. Participation in Project BudBurst can provide an engaging, real-world context for learning about ecology, earth science, geography, and mathematics, while also providing students first-hand experience with scientific practices.





The the Community Collaborative Rain, Hail and Snow network (pronounced ‘co-co-row-z’) is a project that began in neighboring Colorado in response to a localized flash flood event in Fort Collins, Colorado in 1997. Following flooding that caused 200 million dollars in damages and the loss of 5 lives, assistant climatologist Nolan Doeskin organized a network of rain gauge watchers. Beginning with just a few dozen volunteers in Larimer County, Colorado, neighbors in nearby counties started to ask if they could join. Then Wyoming joined, followed by Kansas and New Mexico... and others started to follow suit. By 2009, CoCoRaHS was mapping daily precipitation in all 50 states and has since become the largest network of daily precipitation data in the country.



charge. Volunteers who wish to participate by submitting precipitation data are required to purchase a 4-inch high capacity rain gauge that is accurate to the 1/100th of an inch. All participating volunteers must use the same model gauge, which costs approximately \$30 and is sold by outside vendors.

Science Background

People have been measuring the rain by some accounts as early as 100AD; however, the earliest rain gauges on record are from the 15th century in Korea, credited to King Sejong (1397-1450). Rainfall was important for agricultural purposes (and still is), and King Sejong decided that it would be easier to measure the rain inside a standardized container rather than digging into the soil to check the moisture content. As much as the containers helped villagers determine their potential harvest, the King used the information to better determine how much to tax the farmers. Fast forwarding, one of the most famous weather observers in U.S. history was none other than Benjamin Franklin, who kept detailed weather records for just over sixty years, including ‘depth measurements’ of precipitation from a standardized container.

How to Participate

CoCoRaHS is open to people of all ages and abilities. Anyone with an interest in the weather, and the willingness to set up a rain gauge in their back yard, school, place of business or elsewhere are encouraged to join.

The typical measurement is taken at 7:00 AM and is meant to cover a 24 hour period. However, options exist for entering multi-day reports when volunteers are not able to check their gauge every day. As a volunteer network, CoCoRaHS does not require daily data entry, although a complete data set is rich in value and volunteers are encouraged to report daily, including ‘0.00’ on days where no precipitation fell.

CoCoRaHS is primarily web-based. All training materials are available free of charge from the Project website and are free to download. Power point slideshows, written instructions, live and recorded web-casts, YouTube videos and animations – CoCoRaHS training materials come in all shapes and sizes.

Registration, viewing data and accessing resources on the Web site are entirely free of

Educator Resources

“CoCoRaHS for Schools” is a perfect win-win-win for everyone involved. Not only do the kids get to use a real scientific instrument and submit data, but their data are actually used by the scientific community. Furthermore, the scientists who use the data are always looking for more, and schools are often times in places where data are sparse and therefore quite valuable.

CoCoRaHS activities meet several of the math and science standards within Common Core and Next Generation Science Standards for all grade levels, and can also be expanded upon in areas such as geography, writing, art and more.





Litterati is a world-wide community that is cleaning the planet one piece of trash at a time. Developed by Jeff Kirschner, this mobile app identifies, maps, and collects the litter we pick up as a community. Litterati is on a mission to create a litter-free world.

Why We Started

Litter is everywhere. Soda cans, plastic bags, and cigarette butts litter the environment, choke wildlife, and threaten our planet. Litterati is tackling this problem one piece of litter at a time.



Geotags provide insight into problem areas, while keywords identify the most commonly found brands and products. This data will be used to work with companies and organizations to find more sustainable solutions.

Map Data

Geotags pinpoint individual pieces picked up worldwide.



Change is happening.

In San Francisco, Litterati was used to demonstrate the percent of litter that comes from cigarettes. The data helped justify an increased sales tax on cigarettes that generated \$4 million of additional revenue allocated to cleaning the city streets.

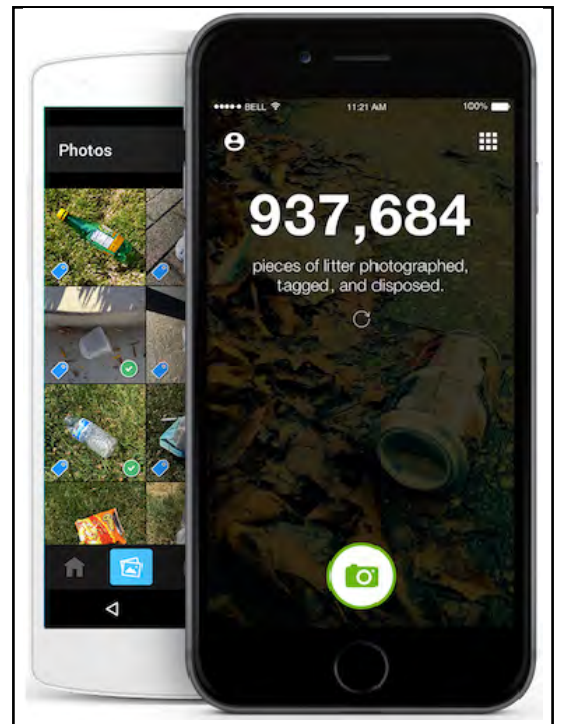
At an elementary school in California, 5th graders tagged and mapped more than 1,200 pieces of litter on their campus. They learned that a major source of litter came from the straws distributed in their cafeteria. They petitioned their principal to stop buying the straws, and the volume of litter dropped dramatically.

A town in Montana used Litterati to visualize the number of cigarette butts littering their public parks. The town intends to pass a tobacco-free parks policy, creating a cleaner and healthier space for everyone.

These are just some of the success stories we've heard from users of the current Litterati app. But we know that so much more is possible.

Download the App for Free

You can download it for free on both iOS & Android.



Project Noah is a digital platform that is designed to allow students, teachers, citizens and biologists to create a database that documents the biodiversity of plants, animals, insects, and much more across the planet. The data uploaded includes photos, geographic location, date, time, and other relevant information about the observations.

Participants can join pre-formed missions to find animals, plants, butterflies, reptiles, or invasive species. Teachers may also set up specific classroom missions for students. This type of crowd sourcing information provides researchers with valuable information about species presence and absences as well as abundance. Participants may upload their spottings online or using a mobile app (iPhone or

Android). There are virtual rewards or “patches” for certain achievements, such as the number of photos posted of birds, mammals, invertebrates or plants. The data that is uploaded is available to teachers for downloading and



using in class for mathematical analysis. For public missions the photos that are uploaded as “unknown” are open for others to suggest identification assistance, which is often quite helpful.

Why This Citizen Science Project is a Strong Candidate for the Classroom:

This project is simple enough for even kindergarten classes to participate.

·Regardless of where you are in the world, and whether you’re an urban or rural school you can participate year round.

·Tools required are minimal and can you can integrate smart phone technology into the classroom.

·Students may participate inside or outside the classroom.

·Teachers may join the global mission set up by Project Noah or create their own missions for their students.

·When creating a class specific mission teachers may create anonymous student numbers/accounts for student safety. Only those in in the class with a specific log-in and URL may participate in or access the mission.

·Project Noah is very visual and an easy way to connect with other students and observers globally.

·Data is available to upload from each mission for supplementing math activities in the classroom.

Online Safety for Children

The Project Noah website can be accessed by the instructor creating their own account and joining pre-formed missions or by creating a class-specific mission. The classroom mission gives teachers the option to create anonymous individual student accounts with specific numbers (you may have as many students as you wish). The URL for the specific class challenge you create is private and only students with their own log-in may access the site. Project Noah will offer to create unique passwords for students or one password that you set for the entire class. Students may also join external public missions but they will still remain anonymous with a student number. They may choose to upload a profile picture (of themselves or an animal) but no other information is required or asked for.

NGSS and Common Core Standards

Project Noah has been correlated by grade for NGSS and Common Core by Karen McDonald. Check it out at: https://blog.scistarter.com/2014/01/citizen-science-in-the-classroom-series-project-noah/?utm_source=scistarter&utm_medium=scistarterblog&utm_campaign=SEPT2014school#sthash.j44IcWhK.dpbs

When not writing her blog, The Infinite Spider, Karen McDonald is a guest blogger, curriculum developer, science content editor, and outdoor educator with over thirteen years in informal science education. Currently she works for Smithsonian and contracts for Discovery Channel.



Lost Ladybug Project lostladybug.org

Across North America ladybug species composition is changing. Over the past twenty years native ladybugs that were once very common have become extremely rare. During this same time ladybugs from other parts of the world have greatly increased both their numbers and range. This is happening very quickly and we don't know how, or why, or what impact it will have on ladybug diversity or the role that ladybugs play in keeping plant-feeding insect populations low. We're asking you to join us in finding out where all the ladybugs have gone so we can try to prevent more native species from becoming so rare.

This project was started by the Cornell University Entomology Department in 2006 and a year after they launched a nationwide search for dwindling native ladybugs, New York researchers began breeding colonies of them from insects found by citizen scientists in Oregon and Colorado. Over 38,000 ladybugs have been identified and uploaded since the inception of this citizen science project.

Getting Started

COLLECT. Keep an eye out for lady beetles. Search in gardens, meadows, bushes, in tree branches, in areas with wildflowers. You may find lady beetles in agricultural fields as well, feasting on aphids. Search alfalfa, clover, wheat and corn fields. If you see aphids on plants, lady beetles may be close by. The best time to search for lady beetles is May to October. Remember that the first step is to collect, not kill. You will be releasing your ladybugs!

TAKES NOTES. Write down (or type in) the date, time, location, habitat and weather at the time your ladybug was collected.

PHOTOGRAPH. Takes pictures of as many lady beetles as you can. You can use a digital cam-



era or the camera on your phone. When disturbed, lady beetles can move quite quickly, making them very difficult to

photograph! Try chilling the lady beetle in the freezer for no more than 5 minutes. Place the adult on gray paper for contrast. Unless photographing a large congregation, try to limit the number of adults in each photograph to 10.

SEND DATA. There are a few different ways that you can contribute your data to the Lost Ladybug Project database:

- Use your computer to upload photos at the Lost Ladybug website

- Use your smart phone by downloading the Lost Ladybug App (for Apple or Droid phones)

- Mail your photos and data to: Lost Ladybug Project, Department of Entomology, Insectary Building, Cornell University, Ithaca, NY 14853

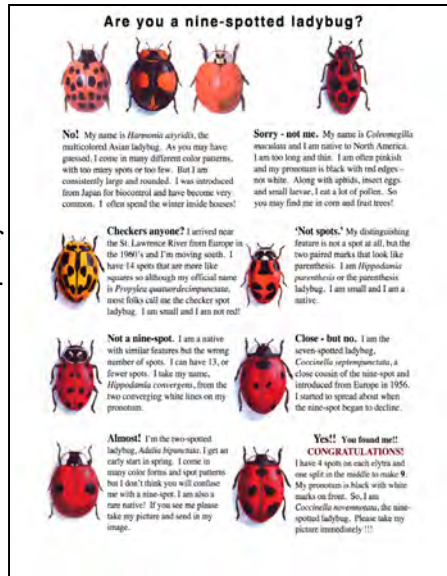
RETURN. Safely release your lady beetles where you found them.

Educational Materials

The Lost Ladybug Project has developed a wide variety of educational materials to share. You will find basic biology and identifica-

tion information, lesson plans with original and unique games, printable pdfs for distribution and outreach, our own coloring book, and even a Lost Ladybug song! This is very much a work in progress.

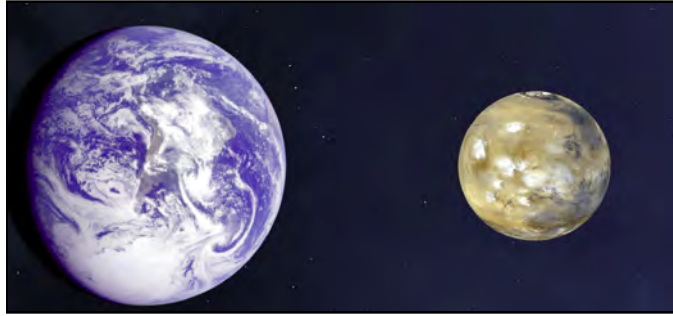
Karen McDonald of the [scistarter](http://scistarter.com) blog page has also correlated this project with NGSS and Common Core standards. https://blog.scistarter.com/2013/12/citizen-science-classroom-series-lost-ladybugproject/?utm_source=scistarter&utm_medium=scistarterblog&utm_campaign=SEPT2014school#sthash.qOOCggha.dpbs



Be A Martian

beamartian.jpl.nasa.gov/welcome

The National Aeronautics and Space Administration (NASA) is asking for help in processing data collected on Mars, in the form of pictures taken by the



Mars Rovers, Spirit and Curiosity. On the “Be a Martian” home page there is a dashboard where teachers or students may create an account with a Martian profile, complete with choosing your alien. Each action, associated with a profile, is given points or virtual badges for participating. Creating a profile is not necessary, you may also participate as a “Martian tourist.” After registering (or not) you will be taken to their Citizenship Hall, which has links for pages with polling, a “theater” with video clips about the rovers, the ability to create a post card to send to the rover Spirit, and an Atlas with geographic information about Mars. Accessed from the Citizenship Hall is the second major page of their website, the “Map Room.” In the map room there is an introductory video about the program and students have the opportunity to try their hands at three types of Martian mapping. These include aligning photos to match topographic images, counting craters, and tagging physical features of the landscape.

Why This Citizen Science Project is a Strong Candidate for the Classroom:

This project can be done in any setting, rural or urban.

- No special tools are required outside of a computer with internet access.
- Students gain a “sense of place” through learning about space and other planets.
- NASA provides a great deal of supporting curriculum, hand-outs, posters, and multi-media resources.

Teaching Materials

Teaching materials that are supplied on Citizenship website, for the “Be a Martian” project, include a Mars atlas with descriptions of different parts of the planet’s surface and the “Two Moons” theater. There are eight different videos in the theater, ranging from

testing the Curiosity’s parachute to students designing human settlements on Mars.

There is also an Educators Page, accessed from the Mars Exploration home page. However it has an extensive curriculum for K-12 as well as supporting resources. Here are just some of the lessons included:

Reflect on Your Community– Design a plan for an Earth community and discuss how it would be made on Mars.

Solar System Scale and Size– Create a model of the solar system that compares size and distance.

Soda Straw Rockets–creating rockets from soda straws.

Marsbound–Using a card game to design a mission and get everyone home safely.

Lava Layering–Modeling lava flow and layering using play dough.

Rover Races–Drawing and designing a rover to meet challenges on the surface of Mars.

Mars Image Analysis–using images to analyze Mars’s surface environment.

NASA also provides resources for the classroom including the “Mars Activity Book.” This is a 131 page document which is full of even more activities and lesson plans K-12. You can also find coloring pages and posters. For 5th-12th grade there is even the option of joining the Mars Student Imaging Project and which would allow your class to actually take pictures from the Mars Odyssey orbiter.

Karen McDonald of the [scistarter](http://blog.scistarter.com) blog page has also correlated this project with NGSS and Common Core. https://blog.scistarter.com/2014/02/citizen-science-classroom-mapping-mars-martian-nasa/?utm_source=scistarter&utm_medium=scistarterblog&utm_campaign=SEPT2014school#sthash.8T3MWOIK.dpbs



Citizen Science for Educators

Here are several educator resources—from curriculum to lessons plans to activities—we compiled for you. *(Editor's Note: This resource list has been provided by the National Conservation Training Center personnel at Shepherdstown, WV)*

SciStarter in the Classroom

This page offers projects for educators in categories from elementary school through college.

http://scistarter.com/page/Educators.html?utm_source=scistarter&utm_medium=scistarter_blog&utm_campaign=SEPT2014school

Citizen Science in the Classroom

This page offers examples of Citizen Science Projects for different school levels (elementary through college).

<http://scistarter.com/page/Educators.html>

Project Budburst

Project BudBurst is on a mission – to get you outside taking a moment to observe how plants in your community change with the seasons. When you share your observations with us, they become part of an ecological record. Spending time outside with plants is calming, educational, and just plain fun.

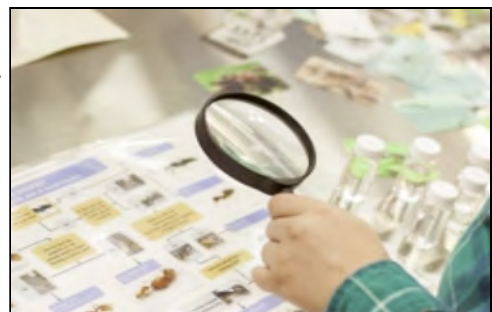
Project Budburst for Educators (general):

<http://budburst.org/educators>

Students Discover

Students Discover offers free, high-quality curriculum to middle school science teachers around the world. These curriculum modules were created in partnership between scientists and educators to support student participation in a broad range of citizen science projects, ranging from measuring fossilized shark teeth to observing bird nests on school grounds.

<http://studentsdiscover.org/>



Below is a sampling of some of the conservation related teaching modules offered, but there are many more on their site!

Notes From Nature:

<http://studentsdiscover.org/teaching-modules/notes-from-nature/>



Nest Watch:

<http://studentsdiscover.org/teaching-modules/nestwatch/>

Bat Detective:

<http://studentsdiscover.org/teaching-modules/bat-detective/>

Starry Night:

<http://studentsdiscover.org/teaching-modules/starry-night/>

Science for Educators – Resources from the Cornell Lab of Ornithology

Consider engaging your students in any of five projects from the Cornell Lab, and access their newest curriculum.

<http://www.birdsleuth.org/citizen-science-educators/>

More at:

8 Great Reasons Why You Should Use Citizen Science in Your Class

<http://scistarter.com/blog/2014/03/benefits-citizen-science-classroom/#sthash.1gtNkTSi.dpbs>

Plan Your Citizen Science Experience:

<http://www.calacademy.org/plan-your-citizen-science-experience>

Integrating Citizen Science into Your Classroom or Organization

http://scistarter.com/blog/2013/12/integrating-citizen-science-classroom-organization/?utm_source=scistarter&utm_medium=scistarterblog&utm_campaign=SEPT2014school#sthash.2mtgUugj.S2IrgeS8.dpuf

Citizen Science Academy

The National Ecological Observatory Network (NEON) manages the Citizen Science Academy (CSA) and offers science resources for educators and online training. One course is “Introduction to Citizen Science: Explorations in Educational Settings.” Participants can earn 2 hours of graduate-level CEUs. Look in this folder for 5 summaries of the citizen science projects in this course.

<http://citizenscienceacademy.org/web/csa/educational-resources>

<http://citizenscienceacademy.org/online-courses>

Federal Crowdsourcing and Citizen Science Toolkit

This toolkit has resources from how-to's, case studies, a resource library and more.

<https://crowdsourcing-toolkit.sites.usa.gov/>

Citizen Science Central Toolkit

The Cornell Lab of Ornithology is hosting this toolkit. Find a variety of resources to help you design/use a citizen science project that works for you.

<http://www.birds.cornell.edu/citscitoolkit/toolkit/steps>



On TRACKS is published by the Kansas Department of Wildlife, Parks, and Tourism one to two times during the school year.

The purpose of On TRACKS is to disseminate information and educational resources pertaining to the natural, historic, and cultural resources of the prairie, emphasizing Kansas ecology. Information is presented from the perspective of current scientific theory.

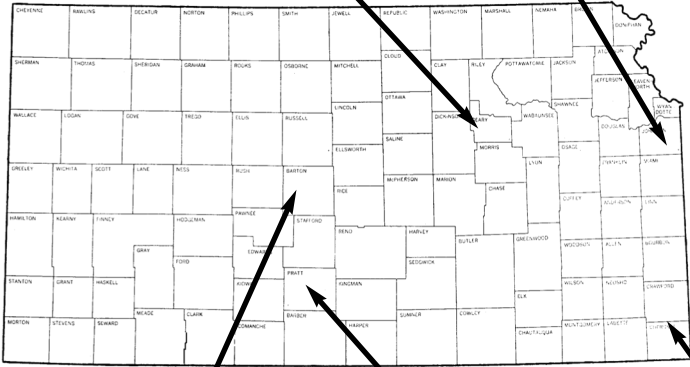
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Equal opportunity to participate in and benefit from programs described herein is available to all individuals, without regards to their race, color, national origin or ancestry, religion, sex, age, sexual preference, mental or physical handicap, or political affiliation. Complaints of discrimination should be sent to: Office of the Secretary, Kansas Department of Wildlife, Parks & Tourism, 1020 S. Kansas Ave, Suite 200, Topeka, KS 66612-1327.

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