

# Yellowstone Citizen Science Initiative

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2018 ANNUAL REPORT

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PHOTO ERIK OBERG

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# EXECUTIVE SUMMARY

 **2115**  
*Number of  
Participations*

 **1788**  
*Effort (Hours)*

 **\$37,268**  
*In-Kind*

## **The Yellowstone Citizen Science Initiative (YCSI) launched its official pilot year in 2018.**

Yellowstone Forever committed to the initiative by identifying it as a priority on the organization's strategic plan, and in March 2018 created a new position, the Citizen Science Program Manager, in order to manage the new program. YCSI is a close collaboration between Yellowstone Forever and the Yellowstone National Park staff, and surrounding communities. All entities see value in this program as it has yielded valid data and quality educational opportunities, and provided unique and enjoyable visitor experiences.

In May 2018, YCSI initiated five research projects. These projects were prioritized by the Yellowstone Center for Resources (YCR) during an annual summit meeting hosted by Yellowstone Forever. Two of the projects (*Invasive Weeds Mapping* and *Home on the Range*) have been ongoing for a number of seasons before the official pilot year, while the remaining projects were completely new.

The Citizen Science Program Manager worked with interested researchers in YCR to create field methods and protocols that were easy to understand, safe, resulted in usable data, and provided for a unique experience while visiting Yellowstone National Park. The Citizen Science Program Manager then worked with Yellowstone Forever Institute staff to develop supporting materials and trained instructors on field methodologies.

The fStop Foundation contributed tablet devices to Yellowstone Forever Institute instructors for use in the field to collect data and document citizen science projects through photography. Zeiss provided field optics used during observation activities and digiscoping.

The following is a report of the YCSI's 2018 pilot season. The numbers reported are compiled from the 2018 calendar year. Each project section contains an introduction, field methods, 2018 results, and engagement metrics. Engagement metrics are defined as: "number of participations," which are the number of engagement events; these numbers may include more than one participation event by a single individual. "Effort" is the amount of time in hours contributed to the project by a citizen scientist. This number does not reflect the delivery of educational content. "In-kind" is the dollar amount equivalent to a volunteer's time, valued at \$20.85/hr., donated to the park during citizen science engagement.

The 2019 season will commence with all five of these projects. Field methods have been refined and on certain projects, complexity has been added. Efforts are being made to make projects more accessible to a wider audience, such as at Yellowstone Forever bookstores. All projects during the 2019 season will have data collected through the application Survey123 and displayed on the platform ArcGIS Online. The use of these technologies is the first phase in a multi-phased approach at building an online interactive tool accessible remotely by citizen scientists to submit, store, analyze and display data.

Affiliated citizen science projects are included in this report to provide a sense of the scope of citizen science in Yellowstone National Park. The three affiliated projects included in this report are led by educators currently associated with Yellowstone Forever and confer some degree of support through Yellowstone Forever.



# **Yellowstone Citizen Science Initiative**

## **2018 PROJECTS**

**Yellowstone  
Citizen Science Initiative  
2018 PROJECTS**

**HOME ON THE RANGE**



PHOTO: MATT LUDIN

# HOME ON THE RANGE

 **1759**  
*Number of  
Participations*

 **390**  
*Effort (Hours)*

 **\$8,126**  
*In-Kind*



## Introduction

***Home on the Range* is a citizen science project that collaborates closely with the Yellowstone Bison Management Team to document ungulate herd demographics and collect scat samples.**

These data are used to quantify competition amongst Yellowstone's ungulate guild. This project also involves successful partnerships with Ecology Project International, Washington State University, Washington and Lee University, and Brown University. Biologists from the Bison Management Team deploy Iridium-GPS radio collars on bison, elk, pronghorn, mule deer, and bighorn sheep during early winter. Each morning, they download information transferred from these collars to Yellowstone Forever and Ecology Project International educators who then use this information to track radio collared animals, make observations, and collect fecal samples. Students at Brown University then analyze diet by identifying the DNA of plant fragments found within scat. Students at Washington and Lee University also analyze scat samples to identify isotopic signatures of plant fragments remaining in samples.

A historically large bison population has caused immediate concern whether there is home on the range for the most diverse and abundant ungulate and carnivore community in North America. From the bottom up, bison are changing the landscape of northern Yellowstone. Grazing pressures are higher than ever observed when elk were dominant and are changing phenology, productivity, and food quality of park grasslands. We do not know the potential consequences for elk, bighorn, mule deer, and pronghorn populations. Effects, in turn, could cascade through the ecosystem because these ungulates are prey to a fully recovered predator guild. This project coordinates data collection among park biologists and YF-led citizen scientists to evaluate bison, elk, bighorn, mule deer, and

pronghorn diet, nutrition, habitat use, migration patterns, birth rates, survival rates, and population growth rates.

This project supports scientific-based management by providing needed information on the influences of bison on other ungulates. The number of bison



PHOTO MATT LUDIN

in northern areas of the park has remained at historically high levels in recent decades despite the removal of more than two thousand bison north of the park during the past three winters. Such movements and spatial structuring were not anticipated under the current plan that guides bison management. Managers and decision-makers need new information on how park resources are being affected in order to guide future management.

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# HOME ON THE RANGE



## Methods:

Contributing data to the *Home on the Range* project may be done at two different levels. The first level is to simply collect herd demographics of any observed ungulate group; the second level involves collecting scat samples. Details for both methods are described below.

### 1. Herd Demographics:

- Use the *Gaia* app on your YF tablet to drop a pin (waypoint), and record location in UTM's.
- Record the demographics of the observed herd on provided data sheets.
- Glass herd for any collared females, record alpha-numeric from the side of collar, e.g. E4.
- If a collared female is observed, document any young of the year (YOY) observed as determined through nursing, contact, or proximity.

These data may be collected on any herd, of any ungulate species encountered while in the field with a group. Please attempt to count different herds each day and avoid always counting herds located next to roads.

### 2. Scat Collection:

- Download .kmz files of current collared-female locations from Google Drive.
- Open .kmz file with Google Earth in order to plan approximate collection location.
- Navigate to last known location using telemetry gear.
- Collect herd demographics—focus on collared female to determine if she has young of the year.
- Collect scat samples—3 samples each from 5 different (fresh) piles in whirl-paks.
- Label as: date, species, animal ID, e.g. 6/1/18 Bison Yell\_085.
- Deposit samples to Yellowstone Bison Project freezer in Mammoth Hot Springs.

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## HOME ON THE RANGE

### Engagement:

***Home on the Range*** is currently engaged through any appropriate YF program. YF instructors have been asked to document herd demographics on a daily basis for any observed herd. Scat collection, which requires a greater time commitment, has generally been implemented through youth programs and select field seminars. It has been encouraged that any time a program lead selects the “Bison at the Border” day itinerary, scat collection would be performed.

Moving forward into 2019, all *High School Field Experience* youth programs will engage Home on the Range as a full day citizen science experience.

A curriculum-based experience is currently being developed by the Yellowstone Forever Institute to formalize *Home on the Range* as a core component of all *High School Field Experience* programs. All college programs, where itineraries are developed in-house, will also engage with this project for a full day. Several *Field Seminars*, including *Hoofed Yellowstone*, *Citizen Science: Field Skills Workshop*, and *Watching Wildlife with a Scientist's Eye* will also include components of this project. Opportunities for any YF program to engage with this project, when appropriate, are available upon request.



PHOTO NPS/NEAL HERBERT

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# HOME ON THE RANGE

## Results:

**In 2018, Yellowstone Forever programs contributed 390 hours with the help of 1759 citizen science participations.** A total of 192 observations, including scat samples from bison, mule deer, pronghorn, and bighorn sheep were collected and submitted to the Yellowstone Bison Project. These numbers do not reflect effort by any other collaborating organization.

During the winter of 2018, Yellowstone Forever citizen scientists, alongside Ecology Project International students, served as the bison “crew” for Yellowstone National Park. This opportunity empowered many Yellowstone Forever participants to contribute to meaningful science and give back to the park.

The herd demographic information was used to calculate annual recruitment estimates of pronghorn, mule deer, and bighorn sheep. These are the first such contemporary estimates that have been made for these species. About 30 bison, 30 elk, 10 pronghorn, 6 bighorn sheep, and 16 mule deer were tracked to continue mapping migration routes. This information will also be used to compare how these species use the Yellowstone landscape, including how they interact and share space. Researchers at Washington State University just recently finished analyzing 90 scat samples that will be used to assess dietary overlap. Students at Brown University are scheduled to complete analyzing an additional 200 scat samples by December 2019.

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## Conclusion:

**Yellowstone Forever, in partnership with the Yellowstone Bison Project and Ecology Project International, will continue the *Home on the Range* project in 2019.** In 2018, *Home on the Range* was the recipient of a Yellowstone Forever 2018 Park Projects Wildlife Grant, which will support this project for the next three years.

A proposal has been made to add two additional metrics to *Home on the Range* in 2019, including songbird and grasshopper (Orthopteran), diversity. These components would expand the project’s collaborative efforts connecting to the Yellowstone Phenology Project and the Yellowstone Bird Program.

Due to the high priority placed on *Home on the Range* by Yellowstone Forever partners at the Yellowstone Center for Resources, the unique experience afforded by this project to park visitors, and the rich educational opportunities, *Home on the Range* will become a core component to all Yellowstone Forever youth programs. *Home on the Range* provides excellent teaching opportunities on a myriad of topics central to understanding Yellowstone, including biology, ecology, political geography, wildlife management, environmental ethics, and stakeholder values. For all the reasons listed above, *Home on the Range* will continue to be central to the success of the Yellowstone Citizen Science Initiative.

# Yellowstone Citizen Science Initiative

## 2018 PROJECTS

### YELLOWSTONE PHENOLOGY PROJECT



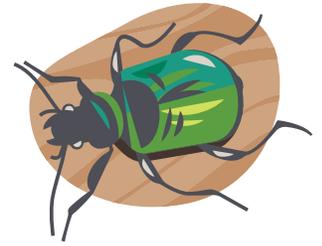
PHOTO LAUREN BELTRAMO

# YELLOWSTONE PHENOLOGY PROJECT

 **152**  
Number of  
Participations

 **1341**  
Effort (Hours)

 **\$27,949**  
In-Kind



## Introduction

The *Yellowstone Phenology Project* is a citizen science initiative designed to monitor environmental change over time across a 5,000' elevation gradient in Yellowstone National Park. The project contributes additional monitoring elements to baseline data gathered at seven sites from Gardiner Basin to the top of Mt. Washburn. These sites were originally established in 2008 by the park's physical scientist Dr. Ann Rodman to monitor pollinator diversity and abundance. Since its inception, remote sensing equipment has been added to these climate change monitoring plots. The *Yellowstone Phenology Project* has established ten invertebrate pitfall traps and three plant transects at all seven climate change sites.

Located in the middle of this elevation gradient, the National Science Foundation's NEON (National Ecological Observatory Network) site completed construction in 2018. The NEON site is one of 81 locations across the United States that utilizes sophisticated methodologies to monitor 32 environmental conditions, including documenting carabid beetle diversity. The *Yellowstone Phenology Project* extends the NEON dataset to cover a wider elevation gradient by replicating the NEON carabid beetle field protocols.

Carabids, collected with pitfall traps, are a well-documented family of ground beetles that may serve as an indicator of environmental health and change. Carabid samples will supplement Yellowstone's beetle catalog housed at the Heritage and Research Center. Other invertebrate samples contained in the pitfall traps will be available to collaborating institutions for further research. Many new park species and range extensions are expected to result from this work. Data derived from *orthoptera* (grasshopper) diversity and abundance

samples will also contribute to *Home on the Range* research objectives.

Plant phenology transects are located at each of the three points associated with the seven climate change sites. Citizen scientists identify plants falling along these transects and document phenophases including first flower, first fruit/seed, and brown out. The timing of these events are correlated with environmental changes.



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# YELLOWSTONE PHENOLOGY PROJECT



## Methods:

**The *Yellowstone Phenology Project* involves servicing ten pitfall traps at each of the seven climate change sites on a two-week cycle.** Center points, located around the perimeter of climate change sites, are located utilizing handheld GPS units. From each center point, pitfall traps are located 40 m away along cardinal directions. Each pitfall trap consists of two plastic cups nested together and placed in an excavated hole approximately six inches deep. The bottom cup contains holes in the bottom to drain any moisture. The second cup serves as the holding container for invertebrate samples, in which 2 inches of propylene glycol (preservative) is placed. The cups are covered with a 1" wire mesh to exclude vertebrate by-catch. A square plastic cover is placed over the entire trap to protect the trap from larger animals and precipitation.

Small teams of citizen scientists navigate to each of the 70 pitfall traps. At each of the traps, the cover is removed. Samples are filtered through fine cloth along with respective labels. The cloth filters and labels are deposited in whirl-paks, and samples are preserved with ethyl alcohol. Whirl-paks are labeled with the date, site name, and pitfall number. Each trap is reset by placing the drain cup first and the second cup is nested with the drain cup and refilled

with approximately 2 inches of propylene glycol. The metal screen and plastic cover are placed over trap and held in place with spikes. Any disturbance to the traps or vertebrate by-catch are documented on digital data sheets.

Pitfall samples are then sorted in the lab utilizing dissecting stereo microscopes to the taxonomic level of order. Once a sample has been sorted to the order level, the order Coleoptera (beetles) is further sorted to isolate members of the Carabid family. Carabids are then pinned and mounted utilizing the Smithsonian Institute's protocols. These carabids are sent to specialists for species-level identification. All other taxa are stored for future research opportunities.

Plant phenology transects are established from each of the three center points associated with all seven climate change sites. Once a center point is located, a tape measure is pulled at a predefined direction off the center stake. A Daubenmire frame is placed on the right side of the tape (while facing away from the center point) at the 5m mark. Target plant species are identified with associated phenophase; data is recorded in digital form on tablets. Repeat readings are made at meter marks along the transect for a total of ten frames per center point.

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# YELLOWSTONE PHENOLOGY PROJECT

## Engagement:

**Implementing the *Yellowstone Phenology Project* required unique considerations due to relatively complicated methods and regular data collection intervals.** To accommodate these requirements, citizen science volunteers were recruited from surrounding communities who would be able to commit to monthly collection events. This group of volunteers, known as the Carabid Crew, was then trained on collection protocols and methods. Volunteers returned during field days to collect data at least once a month for two days of work in exchange for lodging at the Yellowstone Overlook Field Campus. Additional “Day Trip” volunteers committed to one day per month and were integrated into both field and lab work as needed. Four PhD entomologists, four entomology graduate students, and ten entomology undergraduates were engaged through this project in 2018.

Several university groups, including the Colorado State University Rocky Mountain Sustainability and Science Network (RMSSN) and the University of Nebraska-Lincoln, were also trained to assist in field days as a part of a larger educational experience. However, these opportunistic groups were limited due to the time commitment required for training and processing.

During winter months when field sites are shut down for data collection, seven lab kits and microscopes

were assigned to volunteers who continue working from home. Workshops were held to train citizen science volunteers on sample processing techniques. This component has extended the effective season of this project and resulted in more samples being processed than otherwise could have been achieved.

Yellowstone Forever and Yellowstone National Park collaborated to promote awareness of the Phenology Project through many avenues. Several YF and NPS social media posts recruited volunteers and described project progress. Yellowstone NP built an [Arthropod Flickr page](#) to illustrate insect diversity. MSU Bozeman *Wanderlust* sponsored a [presentation](#) given by Erik Oberg, featuring the project with 145 people in attendance. The *Yellowstone Phenology Project* was featured in the [Yellowstone Quarterly winter magazine](#) and in the 2018 issue of [Yellowstone Science](#). Victoria Ibarra, an NPS Mosaic in Parks intern presented a poster in Washington DC highlighting her participation. Phenology Project participant Sarah Whipple and Project Co-Leader Joshua Theurer both gave presentations respectively at the 14th Biennial Science Conference of the Greater Yellowstone Ecosystem, and a regional citizen science workshop in Rocky Mountain National Park. The most recent [Telemetry podcast](#) also describes the importance of the *Yellowstone Phenology Project*, which will be released in early 2019.

PHOTO NPS/ALEX ZAIDEMAN *Poecilus scitulus*



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# YELLOWSTONE PHENOLOGY PROJECT

## Results:

**During the 2018 pilot season, the *Yellowstone Phenology Project* engaged 152 participation events, resulting in 1341 hours of effort.**

This included 28 college students from two different universities.

The project attracted two volunteers from Louisiana who donated 186 hours of sorting and pinning in a mobile lab set up in Yellowstone Forever condos. These volunteers pinned a collection of 2,280 beetles. It is remarkable to consider that this pilot program contributed 75% of the total 2018

citizen science volunteer hours by only 7% of the participations events. This demonstrates a strong desire for and willingness to commit to in-depth, hands-on stewardship experiences. It also attracted a diverse range of students, subject matter experts, local residents and retirees.

The 2018 season also generated valuable plant phenology data forming baseline information and cataloging of represented species found at monitoring sites. Plant phenology methods will be refined to make this aspect of the project simpler.

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## Conclusion:

**The *Yellowstone Phenology Project* will continue to collect pitfall samples and monitor plant phenology in 2019.** Due to the project's complexity, volunteer recruitment and training will continue to be a controlled system. Calls for 2019 volunteers will be made through Yellowstone Forever's website, and other available platforms in January 2019.

The *Yellowstone Phenology Project's* high success is attributed to dedicated project leaders. Erik Oberg, National Park Service, is instrumental in all aspects of the success of this project. Erik will continue to champion this project with the support of Yellowstone Forever.

Winter sorting and mounting efforts will continue through this winter. The first training workshop was held on the campus of Montana State University in October. Seven volunteers have committed to sorting samples from home over the 2019 winter months. Two volunteers were recruited with a two-month commitment and will sort samples while staying in YF housing.

The *Yellowstone Phenology Project* is a model for citizen science collaboration efforts emphasizing private/government partnerships.





# Yellowstone Citizen Science Initiative

## 2018 PROJECTS

### RED-TAILED HAWK NEST MONITORING



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# RED-TAILED HAWK NEST MONITORING

 **53**  
Number of  
Participations

 **12**  
Effort (Hours)

 **\$247**  
In-Kind



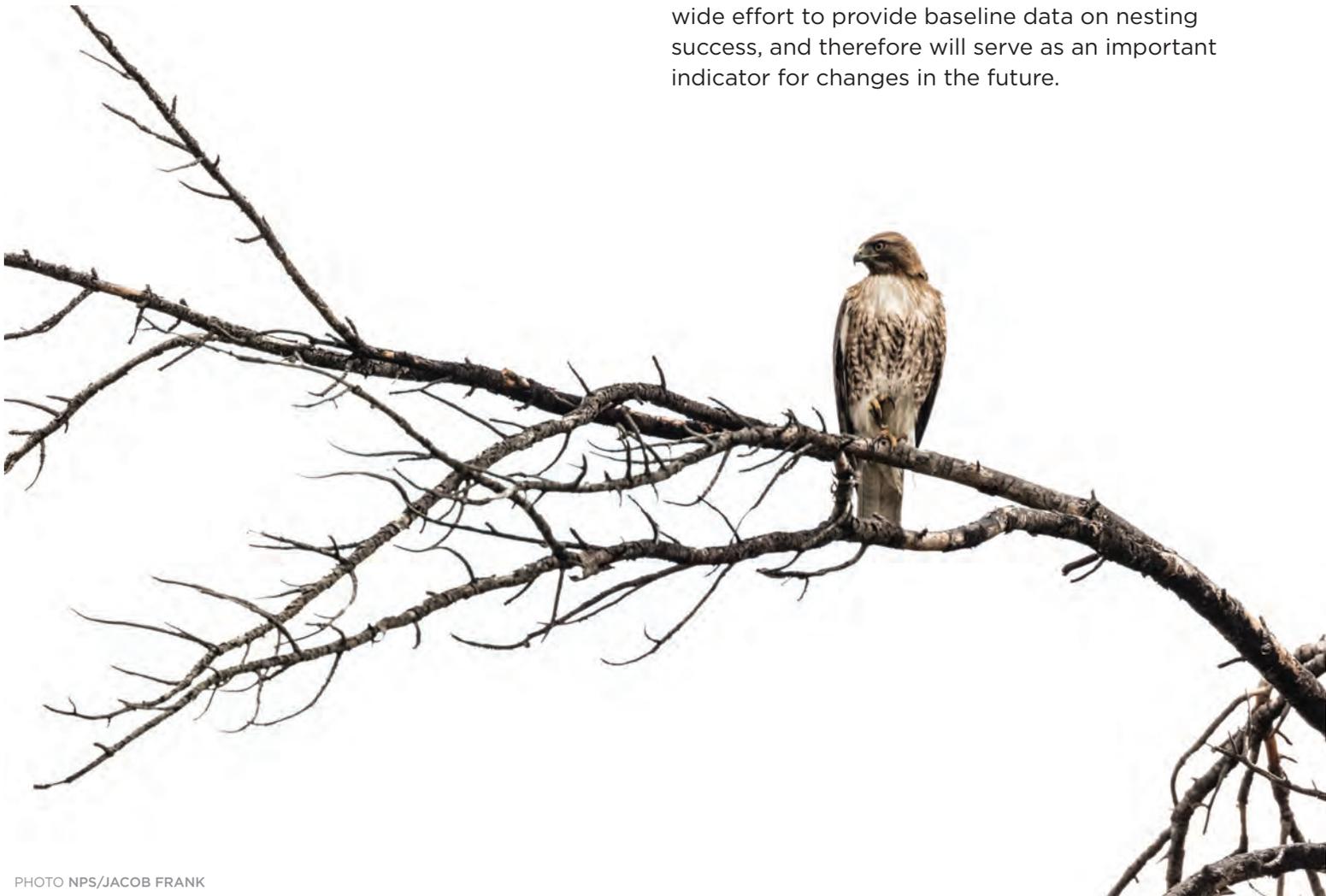
## Introduction

The *Red-tailed Hawk Nest Monitoring Project* is a program that utilizes citizen scientists to monitor the nesting success of red-tailed hawks, *Buteo jamaicensis*, across Yellowstone's Northern Range. This project is a continuation of the *Yellowstone Raptor Initiative* which was a 5-year National Park Service program designed to provide baseline information on select birds of prey.

Red-tailed hawks are a ubiquitous raptor across much of North America, including Yellowstone National Park. From 2011 through 2015, the

*Yellowstone Raptor Initiative* monitored red-tailed hawk territories in the northern range for occupancy, nest success, and productivity, providing a valuable dataset against which to compare future monitoring efforts. Since the end of the *Yellowstone Raptor Initiative* in 2015, however, the Yellowstone Bird Program has been unable to continue monitoring this species.

Red-tailed hawks are charismatic, common, and easily recognizable, making them ideal candidates for a citizen science project with national application. This project is a subset of a continent-wide effort to provide baseline data on nesting success, and therefore will serve as an important indicator for changes in the future.



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# RED-TAILED HAWK NEST MONITORING

## Methods:

Utilizing territory maps and nesting sites documented in 2015 by the *Yellowstone Raptor Initiative*, citizen scientists navigated to observation points to determine territory occupancy as indicated by the presence of a mated pair, a single hawk exhibiting territorial behavior such as undulating flight, nest structures containing new material, i.e. fresh greenery, or by other reproductive related activities, e.g. nesting material exchange, aerial displays, incubation posturing, etc.

If the territory is determined to be occupied by a nesting pair, a minimum of 20 minutes observing with field optics is required to determine the nesting phase, e.g. courtship, nest building, incubating, etc. Occupied territories and active nests are to be revisited throughout the summer in order to document the succession of nesting phases and determine nesting success, i.e. fledging birds. A minimum of four hours of observation throughout the nesting season is required to determine a territory is unoccupied.

New territories or nests may be documented by recording nest locations in UTM's, location of observation point in UTM's, and nest description including direction from observation point, nest structure, and height of nest on structure. Photographs of new nests should be taken using digiscoping equipment. Photos should depict a broad view of nest location, and preferably a closer view of nest condition within nest structure.

Citizen scientists are not to approach within 200m of an established or suspected raptor nest site.



PHOTO JOSHUA THEURER

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# RED-TAILED HAWK NEST MONITORING



PHOTO NPS/JACOB FRANK

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## Engagement:

Currently, the *Red-tailed Hawk Nest Monitoring Project* may be engaged by any Yellowstone Forever Institute group or National Park Service group during nesting season (May through August). Many of the sites are located near roads, while others are backcountry sites requiring much more effort to access.

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## Results:

The 2018 pilot season of the *Red-tailed Hawk Nest Monitoring Project* engaged 53 YF participants, resulting in 12 hours of effort. A total of 4 nests were identified, including a new nest near Junction Butte.

An active nest located in Lamar Canyon was monitored from May to July, resulting in the observation of two nestlings. A nestling was observed being knocked out of the nest by an adult during a feeding event on July 6<sup>th</sup>; the nestling tumbled to the ground. The second nestling successfully fledged.

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## Conclusion:

Yellowstone Forever, in partnership with the Yellowstone Bird Program will continue to monitor red-tailed hawk nests in 2019. Yellowstone Forever will be recruiting up to four volunteers to assist with nest searching in late April 2019. If we are able to identify active nests early in the season, engagement with this project will be simplified. Instead of locating nests, YF instructors along with citizen scientists will be asked to monitor the status of these nests from established observation points. We believe simplifying the tasks will result in increased observations and numbers of participants due to YF instructors feeling more confident regarding the locations of nesting sites.



# Yellowstone Citizen Science Initiative

## 2018 PROJECTS

### YELLOWSTONE PIKA PROJECT



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# YELLOWSTONE PIKA PROJECT

 **139**  
Number of  
Participations

 **44**  
Effort (Hours)

 **\$925**  
In-Kind



## Introduction

The *Yellowstone Pika Project* is a citizen science effort that aims at monitoring habitat occupation of American Pika, *Ochotona princeps*, throughout Yellowstone National Park. These monitoring efforts are a continuation of the *Pikas in Peril Research Project*, started by the National Park Service in 2010, and monitored site occupation and characteristics until 2011.

Pika are known to be an indicator species of climate change in mountainous environments. Pika are sensitive to warming summer temperatures and rely on the insulating qualities of snow in the winter to shelter them from harsh conditions. As average summer temperatures increase, and as snow pack properties change, pika have shown a general tendency to migrate up in elevation when possible, seeking cooler temperatures and reliably deeper snowpack.

Pika are a unique alpine inhabitant. As a lagomorph, or member of the rabbit family, pika consume herbaceous material and spend much of their summer time collecting grasses and forbs which they cache as “hay stacks” for winter forage. The quality and quantity of this forage is vital to the pika’s survival as this is the only available winter food to this non-hibernating species.

The Yellowstone Forever Institute joined monitoring efforts established independently in 2014 by Yellowstone National Park Education Ranger Matt Ohlen. Our goal is to monitor historic pika sites for continued occupation, document new sites that pika are utilizing, and use this project as a way to educate the public about the threats to this charismatic species in the face of a changing climate.



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# YELLOWSTONE PIKA PROJECT

## Methods:

During the 2018 pilot year, the *Yellowstone Pika Project* continued the simple presence/absence surveys established by Matt Ohlen. This survey technique involved navigating to a previously established pika site, as identified originally by the *Pikas in Peril Research Project*, utilizing a handheld GPS unit. The first step in the process is a 15-minute auditory survey in which project leaders and citizen scientists listened for pika calls. Once pika were detected they were determined to be present and the survey stopped.

If, after 15 minutes of auditory surveying, pika are not detected, then the citizen scientists begin a 15-minute visual search for fresh pika sign, i.e. scat or haystacks. Scat or haystacks must be determined to have been deposited during the current growing season. Scat or haystacks that are completely desiccated and contain no green material cannot be determined to be from the current season. If no sign is visually detected, pika are determined to be absent from the site. Surveys must be conducted three times throughout the season, all concluding pika are absent in order for a site to be determined abandoned.

Once surveys are complete, either through detection or running the course of the time allotted, site characteristics are documented. These characteristics include elevation, slope, aspect, and maximum and minimum surface temperatures using an IR temperature gun. New pika monitoring sites may also be established where pika are detected opportunistically.

## Engagement:

Currently, the *Yellowstone Pika Project* may be engaged by any Yellowstone Forever Institute group or National Park Service Youth Conservation Corps and other National Park Service Youth Programs. Many of the sites are located near roads, while others are backcountry sites requiring much more effort to access.

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## Results:

The 2018 pilot season of the *Yellowstone Pika Project* engaged 139 participations, resulting in 44 hours of effort. A total of 12 surveys were completed, including the identification of one new site near the Hoodoos area. One survey conducted at Sheepeater Cliff yielded no detection, but the site was only surveyed once, thus “abandonment” was not determined.

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## Conclusion:

Due to the charisma and public awareness of pika and the effects climate change may play on this species, there seems to be opportunity to collaborate with other NGOs outside of the national park boundary in order to expand this project to an ecosystem wide effort. This would widen the scope of the data and drive greater engagement. These opportunities were further investigated during the winter of 2018-19 and will possibly be implemented during the summer of 2019.

Yellowstone Forever, in partnership with the National Park Service, intends to continue this monitoring effort in 2019 after refining survey methodologies. We also intend to make pika site locations available to a wider audience in order to increase public engagement and awareness of the issues facing pika.



PHOTO NPS/JACOB FRANK



# Yellowstone Citizen Science Initiative

## 2018 PROJECTS

### INVASIVE WEEDS MAPPING



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# INVASIVE WEEDS MAPPING

 **12**  
*Number of  
Participations*

 **1**  
*Effort (Hours)*

 **\$21**  
*In-Kind*



## Introduction

**Invasive weeds affect park resources in many ways.** First, they compete with native vegetation and generally lower the species diversity in any given community. Secondly, they provide little to no forage value for wildlife. Lastly, the park and surrounding states spend millions each year attempting to combat these invaders, diverting funds from proactive conservation efforts.

Yellowstone National Park has identified 7 focal species to monitor: cheatgrass (*Bromus tectorum*), spotted knapweed (*Centaurea maculosa*), yellow star-thistle (*Centaurea solstitialis*), musk thistle (*Carduus nutans*), houndstongue (*Cynoglossum officinale*), common mullein (*Verbascum thapsus*), and dalmatian toadflax (*Linaria dalmatica*). Some of these species, such as cheatgrass, have a strong hold in Yellowstone and monitoring them will inform resource managers about the distribution spread rate from roadsides into the backcountry. Other species such as yellow star-thistle have not been documented inside of park boundaries. Citizen science efforts help us launch an early rapid response to any new invaders detected. Yellowstone National Park staff control invasive weeds through mechanical removal and chemical applications when feasible.

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## Methods:

**Once focal species are identified, a photograph that supplies both location and the extent of the patch of weeds is taken.** Any camera that geotags photos (imprints metadata of the photograph's location) in UTM's is suitable; most smartphones have this capability. Survey123 is the software platform that the National Park Service uses to report these photos and survey efforts.

## Engagement:

Currently, the *Invasive Weeds Mapping Project* may be engaged by any **Yellowstone Forever Institute group or National Park Service group**. Road-side areas have been well documented. Groups accessing trails or areas more than .5 miles from a road are encouraged to document invasive weeds.

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## Results:

**The 2018 season of the *Invasive Weeds Mapping Project* engaged 12 YF participants, resulting in 1 hour of effort.** A total of 3 surveys were completed utilizing Survey123. All completed surveys in 2018 were completed by a single YF instructor.



PHOTO NPS/JACOB FRANK

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# INVASIVE WEEDS MAPPING

## Conclusion

**2018 was the second summer season that Yellowstone Forever has assisted in mapping invasive weeds in Yellowstone National Park, but the first year YF has attempted to utilize the sampling application Survey123.** An attempt was made to register YF instructors as “guest” users of the National Park Service’s Survey123 account. However, due to NPS IT complications, YF instructors were not able to successfully register. Several attempts through the summer were made to register instructors; all failed with the exception of two instructors late in the summer season.

Yellowstone Forever will continue to monitor invasive weeds in 2019. Yellowstone Forever is in the process of obtaining its own user account through Esri, the company that created Survey123. This platform will allow each instructor to easily document invasive weeds while seamlessly providing the data to the National Park Service in a consistent and efficient manner.





# Affiliated Projects

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## NORTHERN RANGE SNOWPACK STUDY

The *Northern Range Snowpack Study* was started in 1994 independently by Dr. James Halfpenny. Snowpits are accessed by citizen scientists at consistent locations in Lamar Valley and Upper Baronnette trail. Snowpits reveal a snow profile that provides information on snow depth, density, and temperature. Beginning in 2018, study methods were adopted by the National Park Service and implemented at 5 new sites across an elevation gradient. The new pits are part of a long-term climate change monitoring program by the National Park Service. All pits will be dug and examinations will again be completed in 2019.

For further information, email Dr. James Halfpenny: [trackdoctor@tracknature.com](mailto:trackdoctor@tracknature.com)



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## BADGERS OF LAMAR

*Badgers of Lamar* is a long-term study of the badger population in the Lamar Valley area that uses observations submitted by citizen scientists. The study began in 2004 and has had contributions continuously through 2018. Data is collected through personal contacts, internet solicitation, and posters placed at the Lamar Buffalo Ranch during Yellowstone Forever classes. Analyses of recent and current year reports are underway and should soon be available.

For further information, to submit an observation, or to view reports: <http://yellowstonebadger.info/>



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## YELLOWSTONE BUTTERFLY COUNT

In 2018, the *Yellowstone Butterfly Count* finished its 15<sup>th</sup> year of data collection. The count has a long history and is currently led by George Bumann who, in 2018, led 15 citizen scientists into the field to collect a total of 652 butterfly observations, including the count's first documented Peck's skipper (*Polites peckius*) and silver-spotted skipper (*Epargyreus clarus*). These 15 citizen scientists contributed a total of 112.5 hours of effort documenting butterflies. They are proud to report the count's highest numbers of large marbles (*Euchloe ausonides*), blue coppers (*Lycaena heteronea*), Shasta blues (*Plebejus shasta*), relict fritillaries (*Boloria kriemhild*), and northern checkerspot (*Chlosyne palla*) butterflies.

The *Yellowstone Butterfly Count* is part of a larger continent-wide effort to monitor butterflies called the "4<sup>th</sup> of July Butterfly Count." This program engages citizen scientists in Canada, United States, and Mexico. The 2019 count is set for July 13<sup>th</sup>, and is slotted for the second day of a two-day Yellowstone Forever field seminar entitled *Observing Yellowstone's Butterflies*; the first day will focus on identification techniques and official counting will commence the following day.

Register for *Observing Yellowstone's Butterflies* by visiting [Yellowstone.org](http://Yellowstone.org) or call: 406-848-2400

Contact George Bumann to be involved in the *Yellowstone Butterfly Count*:  
[info@GeorgeBumann.com](mailto:info@GeorgeBumann.com)



PHOTO NPS/DIANE RENKIN



# 2018 Contributions

Donor:	Amount:
Veverka Family Foundation	\$10,000
Highfield Foundation	\$4,000
Mark Rosolowsky	\$500



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**And mostly to our CITIZEN SCIENCE VOLUNTEERS for their many hours of service!!!**

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