2013 Citizen Science Annual Report



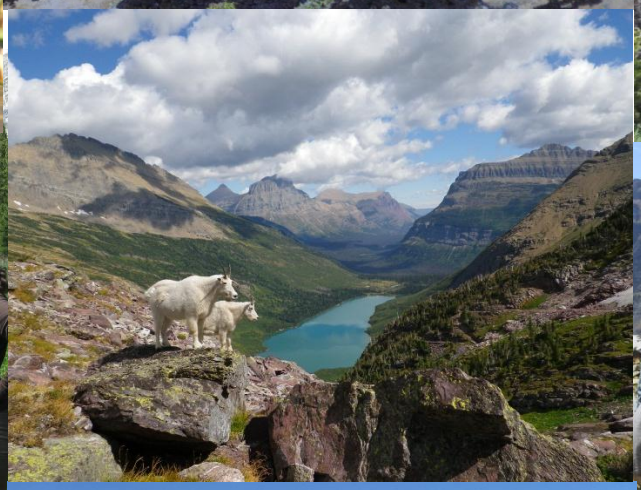






















2013 Citizen Science Annual Report

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Report written by: Jami Belt, Elizabeth Flesch and Taylor Hanson

Program funding: Glacier National Park Conservancy

Cover photos by: Jami Belt (NPS), James Geise (NPS), and citizen science volunteers- Len Kopec (mountain goats), Sumio Harada (pika), Nancy Lundgren (loons), Jane Ratzlaff (bighorn sheep) The Woods Project (Jami Belt with The Woods Project students, lower left corner)

2013 Citizen Science Summary, Statistics and Highlights

Overview of citizen science efforts

- In 2013, 131 citizen scientists, and 85 members of outreach groups were active in one or more of our projects, completing at least one survey during the 2013 season (73 citizen scientists completed at least 3 surveys)
- We trained 159 new citizen scientists (including 78 outreach group participants)
- We trained 129 students (98 high school, 11 middle school and 30 university students) and 41 Glacier Youth Conservation Corps interns
- Citizen scientists completed 537 surveys and over 7,842 hours of survey effort. This is an in-kind contribution of $156,840, equivalent to 13 full-time (GS-5) employees for 20 week field season (May- September)

Internships

- We mentored 2 outstanding interns (1 UM student and 1 recent MSU graduate)
- We supervised 12 VIP's who completed 3,170 in FY 2013

Outreach and education

- We conducted numerous educational outreach programs, training the participants about the ecology and concerns of the wildlife and plant species we are monitoring, and engaging them in data collection. Approximately 278 individuals were educated during outreach presentations. We worked with 192 students and 34 teachers during outreach programs.
    - Flathead High School International Baccalaureate class (65 in 3 classes in spring 2013, 20 in 2 classes in fall 2013)
    - University of Illinois, Conservation Ecology Course (15)
    - Glacier Youth Conservation Corps (Montana Conservation Corps) (41)
    - Climate Change Teacher Workshop (19)
    - Browning Middle School (11)
    - University of Montana/ Flathead Lake Biological Station Ecology course (8)
    - University of Montana Climate Change course (7)
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    - Master Naturalists (10)
    - Flathead Valley Community College Adaptive Resource Management Course (9)
    - Glacier Alumni Picnic (40)

<u>Common Loon Citizen Science Project</u>

- Loon citizen scientists contributed over 3,003 hours of survey effort
- Citizen scientists completed 238 loon surveys
- We conducted 12 training sessions (including outreach groups who conducted surveys) with 48 participants. Three returning citizen scientists went through training as a refresher during group surveys or one-on-one sessions
- 112 citizen scientists conducted loon surveys

Common Loon monitoring results

Season Long

During 2013 citizen scientists conducted at least 3 surveys at all priority 1, 2 and 3 loon lakes and surveyed all 45 loon lakes. We conducted spring loon surveys at 25 lakes to determine territorial status of loons on each lake.

Throughout the course of the season 47 resident adults and 8 chicks were observed. The adults were comprised of 17 pairs and 13 singles with the 8 chicks being in 6 broods. The North Fork had 5 successful nests and the Lake McDonald area had 1 successful nests. Unsuccessful nesting areas included 1 in the Many Glacier area and 2 in the North Fork. The number of chicks seen season long this year was equal to the number of loons detected during loon days. A banded loon was reported on Bowman Lake, our first record of a banded loon ever in Glacier National Park. The band returns indicated that the adult male loon was banded at Teepee Lake in the Whitefish Range outside of the park and had lost its territory at that lake.

Loon day

During Loon Days there were 20 observers contributing 264 hours to survey all of the 45 lakes. There were 34 adults seen (10 pairs and 14 singles), and 8 chicks observed. 1 chick was seen on Hidden Meadow, 1 on Logging, 1 on Howe, 2 on Middle Quartz, 2 on Winona and 1 on Quartz Lake. The chick on Quartz Lake represents the first record of nesting on that lake since monitoring began in 1988. This compares 40 adults, 15 pairs, and 7 chicks observed in 2012.

<u>High Country Citizen Science Project</u>

2013 Results:

- High Country citizen scientists contributed over 4,386 hours of survey effort, (2,857 hours for mountain goat/ bighorn sheep surveys and a total of for 1,529 hours pika surveys (1,177 hours for surveys at I & M pika sites and 352 hours for surveys at additional pika sites)
- Citizen scientists completed 176 mountain goat, 9 of these surveys were at unofficial sites
- Citizen scientists completed 79 pika surveys
- We conducted 14 training sessions (including outreach groups who conducted surveys) with 59 participants. We re-trained 12 returning citizen scientists during groups surveys or one-on-one sessions.
- 126 citizen scientists conducted mountain goat/ bighorn sheep surveys
- 73 citizen scientists conducted pika surveys

Mountain goats and bighorn sheep

Mountain goats and bighorn sheep are counted during a one-hour observation period, and citizen scientists document number, sex and age of goats observed and behavior and habitat. Our goal is to survey each site at least three times per season; ideally once during Mountain Goat Days in mid-August, once before and once after. In 2013, citizen scientists completed least 2 surveys at all of the 37 mountain ungulate sites and 3 or more surveys at all but 3 sites (Upper Nyack, Janet Lake and Fifty Mountain- plans impacted by government shutdown).

In 2013 the Glacier National Park Citizen Science Project formed a partnership with the Greater Yellowstone Area Mountain Ungulate Project. The Greater Yellowstone Area Mountain Ungulate Project is a collaborative research effort that focuses on bighorn sheep and mountain goat ecology in the Yellowstone ecosystem. Mountain goats are considered a non-native species in the Greater Yellowstone Area, and their spread in distribution across the region has raised concerns regarding their potential impacts on native bighorn sheep. In contrast, Glacier National

Park contains native populations of both bighorn sheep and mountain goats. Glacier National Park's setting provides an excellent opportunity to study natural distribution and sympatry of mountain ungulate species. Comparison of mountain ungulate data between native mountain goat range (Glacier National Park) and non-native range (Greater Yellowstone Area) could lead to significant ecological insight regarding mountain goat ecology and interaction with bighorn sheep in different settings.

Mountain Goat Days

With help from 33 volunteers that contributed over 428 hours, citizen scientists conducted an index count of mountain goat and bighorn sheep populations at representative sites throughout nearly the entire park between August 24th and 27th. In total, 82 goats (36 at survey sites during official survey periods and 36 outside of survey sites or outside of survey periods) were recorded. These index counts represent a snapshot of the population at representative sites from year to year, but do not represent a park-wide population estimate.

Year	Sites	Total Goats	Volunteers	Hours
2013	41	82	33	428
2012	34	118	27	414
2011	32	78	20	355
2010	36	155	31	585
2009	36	134	34	548
2008	34	151	46	414

Pikas

In 2012, Glacier National Park was the National Park Service's eighth National Park to join the Pika Inventory and Monitoring (I&M) Program. Through this program 47 survey sites were established and mapped by technicians (see "Pilot testing a pika monitoring protocol in Glacier National Park" for details on site selection and establishment).

In 2013 our goal was to conduct pika surveys at 47 survey sites to determine whether a site is currently occupied, formerly occupied or unoccupied. Volunteers conduct pika surveys by locating a site marker, defining a 24 meter^2 area (representative of an individual pika territory), conducting a 5 minute observational survey, then traversing the talus for 15 to 30 minutes, documenting the presence of scat, haypiles, pikas or calls. Pika scat and photographs of haypiles are collected. Current occupancy of pikas is confirmed if citizen scientist sees a pika, collects fresh scat, or observes a fresh haypile during a survey. Each site is surveyed up to three times or until current occupancy is confirmed. A site is considered formerly occupied if only old scat or old haypiles are detected. After three surveys, a site that is not confirmed as currently occupied or formerly occupied is considered unoccupied. If current occupancy or former occupancy is not confirmed at a site that is surveyed less than three times, it is considered unconfirmed.

Glacier National Park is the first park that is conducting these surveys using only citizen scientists, rather than paid biological science technicians. More parks are likely to transition to using citizen scientists for their pika monitoring in future years due to lack of long-term funding.

To assist with this effort, an additional goal was to make recommendations to the I & M program for ensuring data quality and for maximizing the reliability of data from citizen scientists. To that end we attempted re-survey at least 12 sites using biological science technicians (citizen science staff) to enable us to compare results from citizen scientists to results from biological science technicians, evaluate detection rates, and determine common sources of error or areas where additional training is needed. We also compiled feedback from citizen scientists to help us refine the protocols for our own use and for use in other parks that will need to use citizen science to continue their pika monitoring efforts in future years.

In 2013, citizen scientists conducted 64 surveys at 43 of the 47 I & M pika survey sites. The four sites that were not surveyed were not surveyed due to missing site markers (in 1 case) and unsafe locations in 3 cases. Current occupancy was confirmed at 31 out of 43 sites (72 %) by detection of with fresh sign or a pika. Formerly occupancy was confirmed at 6 sites . Six sites were classified as unconfirmed. Citizen scientists also conducted surveys at 5 sites that were formerly monitored using the GNP protocol from 2008-2011 and 5 sites that were discovered by the observer.

Invasive Plants Citizen Science Project

2013 Results:

- 387 Hours Volunteered (not including Noxious Weed Blitz)
- Eleven Noxious Weed Blitz participants contributed an additional 66 hours of volunteer effort
- 38 trails and sites surveyed
- 44 surveys completed
- 44 citizen scientists completed at least one survey (18 citizen scientists completed 3 or more surveys) during the 2013 season
- We conducted 6 training sessions (including outreach groups who conducted surveys) with 69 participants (including 2 returning citizen scientists and 61 outreach participants and Noxious Weed Blitz attendees)

Invasive Plant Monitoring:

Citizen scientists search for 5 targeted invasive plants and 3 additional watch list species while hiking along trails. Locations of any invasive plants detected are recorded with GPS units, size of patch is estimated, and distribution and stage of growth is recorded. The primary goal is for citizen scientists to assist Glacier's Invasive Plant Management Team with early detection/rapid response by documenting invasive plants in locations that park staff cannot regularly survey. During the 2013 season, citizen scientists surveyed 229 miles of backcountry trails surveyed, hiking over 387 miles.

Citizen scientists are trained in one of two ways: 1) completing an on-line training session that is posted on Glacier's website, or 2) attending our Annual Noxious Weed Blitz. In 2013 we trained 11 participants during the Noxious Weed Blitz. During traditional classroom/ field training sessions we also trained 41 Montana Conservation Crew interns, and 2 previously trained citizen scientists. We announced the Invasive Plants Citizen Science Online Training in two press releases and in 2013, 6 participants completed training using the on-line training module before their visit to the park. We also started a partnership with Flathead Valley Community College's Adaptive Resource Management Course. The course instructor and 9 FVCC students conducted the on-line training and then came to the park to review, ask questions

and practice identifying weeds in the field. They visited the park during two additional field trips to conduct weed surveys and assist with weed pulling. We solicited and compiled feedback on the on-line invasive plant training materials from all trainees.

In 2013 we also explored the use of an invasive plant app for smartphones developed for the National Park Service. We worked with the app developers to help with metadata development and attempted to receive permission to be one of the 5 parks to pilot test the app, but did not receive a response. We will pursue this again in 2014 as a means to expand our audience and increase the coverage invasive plant detection on backcountry trails.

2013 Citizen Science Program Accomplishments

Citizen Science program coordination

- Trained 159 new citizen scientists for all 3 projects, including 78 participants trained during outreach programs listed under "Outreach and Education"
- 131 citizen scientists and 85 outreach participants were active in one or more project(s), completing at least one survey. 73 citizen scientists completed at least 3 surveys.
- Trained over 129 students (98 high school,11 middle school and 30 university students) and 41Glacier Youth Conservation Corps interns

Leadership and supervision

- Internships- hired, trained and supervised 2 outstanding interns
- Supervised 12 VIP's who completed 3,170 hours in FY 2013
- Completed Operational Leadership training
- Non-motorized vessel certification for all staff and 5 VIP's
- Trained all staff on snow travel, stream crossing, driving safety, radio use, etc.
- Volunteer award- Barbara Summer awarded MT Loon Society's Volunteer of the Year
- Volunteer appreciation- issued certificates to all participants who conducted at least one survey and recognition items to all VIP's who completed 80 hour commitment
- Held bi-monthly staff meetings with interns to provide and solicit feedback

New program development

- Bighorn Sheep monitoring- conducted literature review on bighorn sheep research in GNP, ecology and monitoring methods and developed training materials on sheep
- NPS invasive plant app- helped with metadata development and attempted to receive permission for pilot testing- will attempt again in 2014
- Glacial change smartphone app- explored idea of camera stations at Grinnell, Sperry and Jackson Glaciers with Lisa McKeon, Bill Hayden and RLC staff
- Raptor migration project- pilot tested one additional location to use as a standardized location. Planned pilot testing at 3 additional sites hampered by government shutdown.
- Christmas Bird Count- agreed to coordinate and started planning
- Facilitated meeting on marmot research in GNP

Recruiting, engagement and new audiences

- Banner year for media- featured in MT Public Radio (3 stories), Montana PBS/ Sentinel High School News Hour, Great Falls Tribune, Hungry Horse News, Flathead Beacon, Daily Interlake, National Parks Traveler, Missoulian, KGEZ, Earth Island Journal, YouTube (Glacier Youth Conservation Partnership podcast)
- East side volunteers- facilitated greater participation by transporting radios equipment to the St. Mary VC and Two Medicine/ Many Glacier Ranger Stations when needed
- Solicited volunteer feedback during 2 appreciation potlucks

Collaboration/ funding/ partnerships

- Greater Yellowstone Mountain Ungulate Project- developed collaboration with Bob Garrott from Montana State University to compare goat and sheep population monitoring and habitat selection and provided 2013 data for comparison and review of compatibility
- Common Loon Working Group- helped CLWG find Loon Day Coordinator for lakes on the Blackfeet Reservation, assisted with lead awareness brochure,
- Mountain goat fecal DNA analysis- developed plan with Gordon Luikart from University of Montana (Flathead Biostation) to be implemented during Logan Pass goat project
- National Parks Foundation Board- presented on citizen science during quarterly board meeting attended by NPS Director and Assistant Director and USWFS Assistant director

- GNPC's Fall for Glacier fundraiser- led field program and provided citizen science speaker and talking points for live auction that raised over $29,000
- Maintained communication with Glacier National Park Conservancy, providing updates, sharing press releases and media with GNPC recognition, inviting staff on field surveys

Assistance with other park programs

- Green Team- acted as primary co-chair, implemented glass recycling, addressed numerous issues with recycling, briefed management team on Green Team progress
- Assisted BBC film crew with location selection, filming ethics and monitoring
- Bat and harlequin projects- assisted with field work and with providing field volunteers

Data Collection

- Citizen scientists completed 537 surveys and over 7,842 hours of survey effort. This is an in-kind contribution of $156,840, equivalent to 13 full time employees for 20 week field season (May- September)
- Completed 238 loon surveys- at least 3 surveys at all priority 1, 2 and 3 loon lakes
- Completed176 mountain goat/ bighorn sheep surveys- 3 or more surveys at all but 3 sites (Upper Nyack, Janet Lake and Fifty Mountain- plans impacted by government shutdown)
- Completed 79 pika surveys- at least one survey at all 44 accessible pika sites
- Coordinated Spring Loon Day and the annual Noxious Weed Blitz
- Oversaw coordination of Summer Loon Day and Mountain Goat Days

Collaboration with other researchers on citizen science target species

- Developed plan in collaboration with I & M Network for best practices for pika data collection, survey site management and evaluation of project results
- Finished work with MT Fish, Wildlife and Parks database coordinator on import of our data to their database
- Coordinated with MTFWP to align GNP and State loon monitoring, reporting standards and definitions to enable seamless analysis and reporting of loon status
- Worked with Biodiversity Research Institute (BRI) to develop MT loon status report
- Recovered loon carcass from Logging Lake, conducted necropsy (with help from Flathead High School students) and submitted specimens to BRI for mercury testing

Training and data collection quality control

- Bighorn sheep ID-developed draft ID card and handout with additional identification tips
- Feedback on on-line invasive plant training materials solicited from all trainees
- Developed advanced training on UTM data collection for goat and sheep sightings to provide info on habitat selection for GYA Mountain Ungulate project
- Created pika survey kits to ensure fingertip access to all needed survey equipment
- Field data collection of UTM locations for ungulates and species of concern- pilot tested use of Trimble Juneau field computer and explored use of iHike for iPad
- Addressed data quality issues by one-on-one re-training with 12 returning volunteers
- Updated survey forms by adding/changing fields to alleviate frequent errors or omission

Logistical needs and volunteer/staff relations

- Maintained excellent relations with backcountry permit staff, subdistrict rangers, dispatch office, etc. to ensure their continued help with survey logistical needs
- Reviewed procedures for fee waivers and facility use with appropriate staff
- VIP guidelines- worked with VIP and backcountry VIP coordinators and safety officer to procedures for VIP selection and management of VIP's with physical restrictions

Data Management

Data entry quality assurance

- Data QA/QC- implemented new three-tiered approach to QA/ QC involving initial review of 10% of data entry by program coordinator for detecting patterns of errors, second review of 100% of data by intern, then third review of 100% by other intern and program coordinator. QA/QC'd all 2013 loon and high country data using this approach
- Archived datasheets and set of duplicate copies- organized alphabetically and by date
- Completed all data entry for 2013 and late season data entry for 2012
- Re-entered and verified all records omitted during database updates
- Added UTM's for most incomplete loon nesting reports from previous years
- Entered backlog of data from entire 2009 loon project including UTM's and QA/QC'd

Metadata reporting

- Metadata and IRMA training with Richard Menicke
- Posted loon project and high country project database metadata on IRMA
- Submitted updates to pika database metadata for I & M project
- Submitted all CS publications to date for inclusion in IRMA
- Participated in Citizen Science.org discussion on data policies and read "Data policies for Public Participation in Scientific Research: A primer"

File organization and project information accessibility

- Organized photos in citizen science photo file and assisted with organization of Research Learning Center photos. *Working to rename photo files with photographer and read me info*
- Added and QA/QC'd all observers from 2010- 2013 excel lists into observer database
- Updated Training Manuals for High Country program and Loon programs with information on data management for ungulates, pikas and loons

GIS

- ArcGIS refresher training with Richard Menicke
- Completed geodatabase for UTM locations of goats and sheep and made map of locations
- Created maps of 2013 mountain goat/ bighorn sheep count data and pika occupancy data

Database management

- Improved loon database- built new data fields and queries to assist with reporting on loon reproductive success and disturbance
- Reconfigured high country database- built new data fields and queries to enable entry of bighorn sheep data and UTM locations of goat and sheep sightings
- Query development- developed and refined queries for annual reports from loon database and high country database
- Pika I & M database- working with pika database coordinator to try to make database compatible with our observer database and to fix data entry errors from 2012 technicians

Reporting and Outreach

Science communication

- Wrote newsletter article on goats and climate change predictions
- Wrote Fair Chase magazine article on mountain goat monitoring in fall 2013 issue
- Assisted with content and revision of common loon resource bulletin
- Assisted with content, completion and revision of mountain goat resource bulletin
- Assisted with revision of pika resource bulletin

Park planning, technical expertise and management recommendations

- Provided input and assisted with Logan Pass mountain goat study

- Provided input for Erik Beever's pika research proposal
- 2012 Pika I & M final report- provided text and reviewed final report
- Developed reports for Environmental Analysis of lake trout removal on Logging, Grace and Quartz Lakes including loon nesting and status histories, threats and mitigations
- Provided content and reviewed manuscript chapters from Chris White and M.E. Hannibal

Annual summary reports

- Completed final report
- Created templates for loon and mountain ungulate final reports for future years
- Pika Inventory and Monitoring annual summary and recommendations completed
- Updated media scrapbook for all citizen science publicity
- Completed training/event section of RLC annual report
- Mountain goat trend analysis- formatted all data for R and *plan to complete analysis by 11/17*
- *Merging all report documents into pdf document for electronic access- plan to complete by 11/17*

Communicating Citizen Science Results

- Shared results during mid and end season potlucks
- Emailed loon and mountain goat day results to all citizen scientists
- Posted mid-season results on facebook- will *post final results and maps by 11/17*
- On-line database- developed priorities, worked on template and compiled sample content

Outreach and education

- Conducted outreach programs with 278 individuals
- Worked with 192 students and 34 teachers during outreach programs
- Conducted classroom sessions and field trips with 85 Flathead High School students using a curriculum that meet state standards
- Reviewed curriculum with Flathead H.S. teachers to align better with International Baccalaureate learning objectives
- Developed curriculum- based ideas with Whitefish High School to pursue in spring 2014
- Reviewed final draft of Glacier Education Strategy

New audiences

- Established a facebook group for citizen science members to announce survey needs, link with hiking partners and post project results etc.
- Weekly groups surveys - invited all citizen scientists for advanced training/ networking
- Worked with Laura Law to integrate park volunteer needs into Master Naturalist program hosted by the Glacier Institute
- New outreach groups included University of Illinois, Glacier Youth Conservation Corps, Browning Middle School, The Woods Project, of Chicago and Houston, Sierra Club of Nevada, Master Naturalists, Flathead Valley Community College Adaptive Resource Management Course, and Glacier Alumni

Additional safety/ trainings/ certifications etc.

- Fundamentals III and IV
- FISSA, NoFear, Smartcard, Retirement Planning training

Citizen Science in Glacier National Park



- Citizen science in GNP engages park visitors and students from a wide range of backgrounds in research, in turn fostering science literacy and resource stewardship.
- Primary goal is to provide reliable baseline data about wildlife and plant species identified as priorities, and to aid with early detection of ecosystem changes.
- Citizen science enables us to begin to address the growing list of research/ monitoring needs in spite of funding constraints.

Accomplishments:

- The program has grown from a 6-week pilot effort focused on Common Loons to an almost year-round program that monitors many wildlife and plant species.
- We have trained over 800 citizen scientists. ~150 citizen scientists are active each year.
- We have engaged over 500 students in citizen science data collection since 2010.
- Citizen scientists have contributed over 30,000 hours (in-kind contribution of $600,000) and conducted over 4,100 surveys
- Our program is one of the National Park Service's first citizen science programs and has served as a model for other parks and agencies.
- This program addresses many of the Call to Action initiatives.
- Our research indicates that large datasets from citizen scientists can yield statistically similar population and distribution estimates to those of biologists/ aerial surveys.

Projects:

Common Loon Monitoring

- A volunteer-based annual loon survey began in 1988, which indicated that GNP hosts 20% of state's loon population and that reproductive rates were low (5 chicks/ year).
- The citizen science program started in 2005, the first in Glacier and one of the first in national parks, to increase monitoring of this sensitive species.
- We have established significant baseline data on loon population status, nesting areas, chick hatch and migration dates, and areas of concern for human disturbance.
- Our goal is to continue this long-term record to provide management recommendations about issues that may affect loon nesting success and habitat, an indicator of lake ecosystem health.

High Country Citizen Science

- This program was created in 2008 to address the need for research on mountain goats, bighorn sheep and pikas- priority species due to their vulnerability to climate change impacts.

Mountain goat and bighorn sheep monitoring

- We have established baseline data on mountain goat population density and distribution.
- Our goals are to continue monitoring mountain goat and bighorn sheep population status, to detect changes in distribution, long-term trends, and climate change impacts.

Pika monitoring

- We have established baseline data on pika distribution and persistence
- In 2012 we implemented Inventory & Monitoring protocols at 60 sites to test the viability of using citizen scientists for long-term Vital Signs monitoring.



Invasive Plant Citizen Science

- This program was created in 2008 to help detect five target invasive plants in the backcountry.
- Citizen scientists assist Invasive Plant Management Team with early detection/rapid response.
- In addition to season-long monitoring we host an annual Weed Blitz (~ 50 participants).
- We have launched an on-line training to engage short-term visitors and school.
- We will pilot-test a smart phone app that has been developed for the National Park Service.

Education and Outreach

- We have engaged over 500 students in citizen science data collection.
- Annually we provide outreach to 150- 250 participants from visiting school groups, universities and community colleges, teachers groups, and other learning groups.
- We developed Youth Exploring Science (Y.E.S!) an innovative curriculum-based program for high school/ middle school groups - an underrepresented group for education in parks- and have implemented it with over 150 local students. During classroom instruction and field trips students develop research questions, collect and analyze field data. We aim to empower students to put the scientific method into action to answer their own questions about the ecosystem.



Program support and needs:

- Each year we are asked to monitor additional species with citizen science, but we are at capacity with staff resources.
- The program is funded year-to year by the Glacier National Park Conservancy, which provides support for one coordinator position (term 8 months with furlough).
- Additional grant support is sought each year from various sources for 2-4 interns to assist with coordinating citizen scientists during the busy field season.
- We need to establish secure funding to sustain current gains, maintain staff consistency, increase the participant to staff ratio and meet additional monitoring requests.

Citizen Science Program History Summary

Citizen Science Programs:
http://www.nps.gov/glac/naturescience/ccrlc-citizen-science.htm

Common Loon Citizen Science Project
2013: 112 participants, 48 new recruits, 238 surveys, 3,003 hours, 47 adult loons, 17 pairs, and 8 chicks
2012: 75 participants, 32 new recruits, 215 surveys, 2,522 hours, 34 adult loons, 14 pairs and 7 chicks)
2011: 112 participants, 31 new recruits, 158 surveys, >2,200 hours, 45 adult loons, 17 pairs of loons and 8 chicks
2010: 105 participants, 33 new recruits, 220 surveys, >1840 hours, 41 adults loons, 18 pairs of loons and 5 chicks
2009: 132 participants, 41 adult loons, 16 pairs of loons, 1,592 hours, and 11 chicks
2008: 120 participants, 1,800 hours, 47 adult loons, 14 pairs of loons, and 7 chicks (6 fledged)
2007: 156 participants, >2,600 hours, 43 adult loons, 10 pairs of loons, and 6 chicks in 5 broods.
2006: 77 participants, 2,903 hours, 45 adult loons, 16 pairs of loons, and 4 chicks in 3 broods.
2005: 46 participants, 1,948 hours, 45 adult loons, 19 pairs of loons, and 7 chicks in 5 broods.

High Country Citizen Science Project
2013: 134 participants, 59 new recruits, 181 surveys 4,386 hours, 176 goat surveys and 35 goats observed during goat days, 79 pika surveys
2012: 123 participants, 71 new recruits, 181 surveys, 2,769 hours, 153 goat surveys and 118 goats observed during goat days, 28 pika surveys
2011: 178 participants, 113 new recruits, 210 surveys, 3,534 hours, 172 goat surveys and 78 goats observed during goat days; 38 pika surveys
2010: 143 participants, 73 new recruits, 213 surveys, 2900 hours, 169 goat surveys and 155 goats observed during goat days; 44 pika surveys
2009: 88 participants, 44 new recruits, 3009 hours, 272 goat surveys & 134 goats observed during goat days; 58 pika surveys including 16 new sites, 36 observations of nutcracker groups or individuals, numbers are not final as field season is not yet over.
2008: 86 participants, 1,392 hours, 186 goat surveys, 46 pika surveys, 44 nutcracker observations

Invasive Plants Citizen Science
2013: 69 trainees, 67 new recruits, 44 active participants, 44 surveys, 453 hours, weeds detected on 23 trails
2012: 90 trainees, 82 new recruits, 28 active participants, 58 surveys, 1088 hours, weeds detected on 25 trails
2011: 94 trainees, 59 new recruits, 82 surveys, 802 hours, weeds detected on 30 trails
2010: 54 trainees, 27 new recruits, 57 surveys, weeds detected on 27 trails
2009: 25 participants, 17 new recruits
2008: 28 participants, 396 hours, 81 surveys

All Projects Combined
2013: 216 citizen scientists (including 85 members of outreach groups), 159 new citizen scientists trained, 7,842 hours (value of $156,840 at standard volunteer rate), 537 surveys, 3,170 VIP hours.

2012: 212 citizen scientists, 197 new citizen scientists trained, 6,380 hours (value of $116,140 at standard volunteer rate).
2011: 191 citizen scientists, 83 new recruits, >6,500 hours (value of $131,000 at standard volunteer rate), 2,530 VIP hours.
2010: 180 individuals, 89 new recruits, 5100 + hours (value of >$75,000 at GS5 rate or $94,000 at standard volunteer rate), 3,640 VIP hours.
2009: 108 individuals, <4,600 hours, 3,189 VIP hours.

Funding

Citizen Science – Loons, High Country & Invasive Plants (Legacy)

2013 Glacier National Park Fund- $35,000
2012 Glacier National Park Fund - $52,000 (includes $7,000 for on-line program)
2012 NPS Youth in Parks - $15,840
2011 Glacier National Park Fund- $50,000
2010 Glacier National Park Fund - $25,000

High Country Citizen Science

2013 FLREA- $14,000
2011 George M. Wright Internship ~ $6,200
2009 Glacier National Park Fund- $25,000
2008 Glacier National Park Fund- $22,000

Invasive Plant Citizen Science

2011 Unilever Foundation - $10,000
2008 NPS Parks as Classrooms- $25,000

Citizen Science for Common Loons

2013 Rocky Mountain CESU grant- Common Loon Citizen Science Internship
2008 Glacier National Park Associates- $5,000- Citizen Science for Common Loons Internship
2007 Glacier National Park Fund- $19,000- Note: Another $16,000 in this account was for the Invasive Plant Field guide.
2007 Glacier National Park Associates- $5,000- Citizen Science for Common Loons Internship
2006 Glacier National Park Fund- $16,000
2005 Rocky Mountain CESU grant- $5,000- Citizen Science for Common Loons pilot year (training GNP staff and participants)

2013 Citizen Science Involvement

Name	# in group	Pika Surveys	Goat/ Sheep Surveys	Loon Surveys	Invasive Plant Surveys	Total Surveys
Baginski, Carole	1		1	4		5
Baginski, Rich	1		1	4		5
Bate, Lisa	1	5	1	1		7
Baum, Bill	1		1	1		2
Belt, Jami	1	11	17	7	3	38
Bennett-Hudel, Julie	1				13	13
Blank , Dee	1		1		1	2
Bramante, Jake	1	1	1	3		5
Carolin, Tara	1	1	1			2
Chalmers, Nancy	1		1	1		2
Chickering, Karen	1			1		1
Chinn, Bob	1	1	12	14	1	28
Clarin, Sam	1		3			3
Clarin, Tim S.	1		3			3
Clothier, Susan	1		9	14		23
Daly, Nicholas	1	1	2	4		7
Donovan, Mary Ann	1		1	2		3
Dooley, Peter	1	1	3	4		8
Fallon, T.J.	1	1	3	7		11
Fitzpatrick, Dave	1			1		1
Flathead High School IB, 1st year 2013	10	7	5			12
Flathead High School IB, 2nd year 2013	9				1	1
Flesch, Elizabeth	1	6	21	1	2	30
Gallagher, Kathy	1			5		5
Glastetter, KC	1			1		1
Gniadek, Steve	1		1	9		10
Greyeyes, Shonto	1	4	5			9

2013 Citizen Science Involvement

Name	# in group	Pika Surveys	Goat/ Sheep Surveys	Loon Surveys	Invasive Plant Surveys	Total Surveys
Haehn, Misty	1		1			1
Hansen, Warren	1			1		1
Hanson, Taylor	1	2	7	18		27
Harada, Kumi	1		1	1		2
Harada, Sumio	1		1	1		2
Hartmann, Sonja	1		1	2	1	4
Headley, Racheal	1	2	6		1	9
Hickling, Jonathan	1				13	13
Hinman, Karen	1		1			1
Hinman, Richard	1		1			1
Hoff, Karen	1		2			2
Hoff, Ron	1		2			2
Horner-Till, Susan	1	4	1			5
Hudel, C.	1				13	13
Jacobs, Amy	1			1		1
Jamerson, Khrystyne	1			11		11
Jameson, Heather	1	3			3	6
Johnson, Brian	1	1	16	11	6	34
June, Nathan	1	6	4			10
Kermath, Leslie	1	1	1			2
Kijewski, Betty	1			3		3
Kopec, Len	1	1	6	5		12
Kotter, Dan	1		1			1
Kratzer, Keith	1		1	1		2
Kyle, John	1		1	1		2
Laird, Diane	1	1				1
Laird, Kassandra	1	1				1
Lawrence, Rebecca	1			1		1
Lees, Jeff	1		2			2
Lemerande, Jordan	1	1	2	2		5
Lundgren, Maria	1		1	3		4

2013 Citizen Science Involvement

Name	# in group	Pika Surveys	Goat/ Sheep Surveys	Loon Surveys	Invasive Plant Surveys	Total Surveys
Lundgren, Nancy	1	4	5	23		32
Marine, Craig	1			2		2
Marine, Marcea	1			2		2
Mauritzen, Clayton	1	1	3	2		6
McCadden, Dominique	1		4	2		6
McClelland, Pat	1		1			1
Meher, Candice	1	5	2			7
Montana Conservation Corps Crews (short-term), 2013	10		6	8	5	19
Mullings, Cyndi	1			1		1
Murray, Matthew	1		5	12		17
Muzik, Crystal	1		2	1		3
Myse, Todd	1		2			2
Newsom, Becky	1	5	3			8
O'Brien, Bev	1				3	3
O'Brien, Bill	1				3	3
O'Connor, Evan	1	1	2			3
O'Connor, Rory	1	1	2			3
Olsen, Roger	1		1			1
Oropeza, Freddy	1	2	2			4
Oster, Stephanie	1	4	1			5
Ouellet, Nicky	1	9	3			12
Panagakis, Andrea	1	2	3			5
Paulson, Sue	1		2			2
Peterson, Chris	1		1	1		2
Peterson, Terry	1	3	1	5		9
Peyton, Stan	1	1	2			3
Raines, Marilyn	1		1			1

2013 Citizen Science Involvement

Name	# in group	Pika Surveys	Goat/ Sheep Surveys	Loon Surveys	Invasive Plant Surveys	Total Surveys
Rasmusson, Par	1	2	3			5
Reeves (Loucks), Debra	1	1		1		2
Ressel, Dawn	1	1	6	2		9
Rinehart, Susan	1	1	6	2		9
Robbins, Dean	1	1	5	3		9
Roche, Alzada	1	5	2			7
Rose, Breanna	1	2	2			4
Rose, Lindsey	1		1			1
Rosenkoetter, Travis	1		2			2
Ross, Kathy	1			7		7
Sarmento, Wesley	1		6			6
Schlepp, John Waven	1	1	3	2		6
Scully, Elliot	1	1				1
Scully, Kevin	1	2				2
Siegler, Jeannie	1	2	4		3	9
Silvis, Matt	1	5	3			8
Sladek, Melissa	1	1	1			2
Smith, Paula	1	1		1		2
Stauffer, Kathlyn	1		2	1		3
Steele, Gail	1	4		6		10
Steele, Theresa	1	1	2	17		20
Stephens, Dow	1		1	1		2
Stewart, Evan	1	4	5			9
Summer, Barbara	1	4	7	18		29
Taylor, Marshal	1		1			1
Taylor, Patsy	1		1			1
Till, Jim	1		1			1
Till, Robyn	1		1			1

2013 Citizen Science Involvement

Name	# in group	Pika Surveys	Goat/ Sheep Surveys	Loon Surveys	Invasive Plant Surveys	Total Surveys
Travis, Paul	1	1				1
University of Illinois, Field Ecology Course 2013	15			3		3
University of Montana, 2013 Climate Change Field Course	7	1	1			2
University of Montana, Ecology Course 2013, Flathead Lake BioStation	8		1			1
Vanderpool, Carol	1		4			4
VanFrankenhuyzen, Kelly Christina	1		2	4		6
Vanhorn, Alex	1	4	1			5
Waldron, Susie	1			6		6
Waller, John	1		1	1		2
Weber, Shana	1	1				1
Weed Blitz, 2013	11				1	1
Welch, Heather	1		4	5		9
West, Sheree	1			2		2
Williams, Becky	1	1	2	4		7
Williams, Larry	1			2		2
Woods Project, 2013	23			6		6
Zavadil, Anne	1	1				1
Zinn, Don	1		2	4		6
Participants by project (not including # in outreach groups)	**131**	**58**	**95**	**67**	**17**	
Total count of participants (including # in outreach groups)	**216**	**73**	**126**	**112**	**44**	
# citizen scientists who conducted at least 3 surveys by project (not including citizen science staff)		**17**	**32**	**30**	**7**	
# citizen scientists who conducted at least 3 surveys (not including citizen science staff)						**73**

Citizen Science Training Sessions

Date	Year	Loon sessions	High Country sessions	Weed sessions	# of hours	New CS attendees #	Returning CS attendees #	VIP attendees #	Outreach group #	GNP/ USGS Staff #	Total Hours of training	Location	Citizen Science staff	Citizen Science Staff hours	Outreach program name	Students	Adults	Teachers/ group leaders	Participation-outreach group	Comments	Total loon attendees	Total HC attendees	Total weed attendees
5/17	2013	1			6	4			15		114	CCRLC	1	6	University of Illinois Ecology Course	13		2	1 day		4	0	0
5/22	2013	1	1	1	6				45		270	MCC-Kalispell	1	6	Montana Conservation Corps	41		4			0	0	0
5/31	2013	1			6	5					30	CCRLC	3	18							5	0	0
6/7	2013		1		10	7					70	CCRLC	3	30							0	7	0
6/10	2013	1	1	1	10	7					70	CCRLC	3	30	Glacier Youth Conservation Corps	7			5 days	retrained portion of group from 5/22	7	7	7
6/11	2013	1	1	1	1				7		7	CCRLC	1	1	Glacier Youth Conservation Corps	7			1 day	retrained portion of group from 5/22	0	0	0
6/12	2013	1			6	5					30	CCRLC	2	12						Montana Public Radio attended and did news story	5	0	0
6/17	2013		1		10	10					100	CCRLC	2	20							0	10	0
6/24	2013	1	1		1	7					7	CCRLC	1	1	Glacier Youth Conservation Corps	7			1 day	retrained portion of group from 5/22	7	7	0
6/28	2013		1		10	15					150	East Glacier Lodge	2	20							0	15	0
6/29	2013	1			6	8					48	CCRLC	1	6							8	0	0
7/3	2013	1	1		4	4			8		48	CCRLC	1	4	University of Montana Ecology Course (Flathead Lake Biostation)	6		2	1 day		4	4	0
7/19	2013	1			6				23		138	Big Creek Outdoor Ed Center	1	6	Woods Project (Chicago and Houston)	18		5	2 days		0	0	0
7/23	2013			1	6	11				5	96	Community Building	2	12	Noxious Weed Blitz						0	0	16
7/29	2013	1	1	1	10	8					80	CCRLC	2	20	Glacier Youth Conservation Corps	7			5 days	retrained portion of group from 5/22	8	8	8
8/14	2013		1		4	1			7		32	CCRLC	1	4	University of Montana Climate Change Course	6		1	1 day		0	1	0
8/26	2013		1		4				10		40	CCRLC	1	4	Sierra Club of Nevada		10		3 days		0	0	0
9/16	2013	1	1		1				7		7	CCRLC	2	2	Glacier Youth Conservation Corps	7			1 day	retrained portion of group from 5/22	0	0	0

Citizen Science Training Sessions

Date	Year	Loon sessions	High Country sessions	Weed sessions	# of hours	New CS attendees #	Returning CS attendees #	VIP attendees #	Outreach group #	GNP/ USGS Staff #	Total Hours of training	Location	Citizen Science staff	Citizen Science Staff hours	Outreach program name	Students	Adults	Teachers/ group leaders	Participation-outreach group	Comments	Total loon attendees	Total HC attendees	Total weed attendees
9/16	2013			1	4				8		32	CCRLC	1	4	Flathead Valley Adaptive Resource Management Course	7		1	1 day		0	0	0
9/18	2013		1		16				9		144	Flathead High School	1	16	Flathead High School IB Course (Ortley- 2nd year)	8		1	1 day	classroom sessions also on 9/11, 9/12, 9/17, 10/2, 10/3, 10/8 and field trip on 9/18	0	0	0
9/20	2013		1		22				9		198	Flathead High School	1	22	Flathead High School IB Course (Cordes- 1st year)	8		1	2 days	classroom sessions also on 9/11, 9/12, 9/17, 10/2, 10/3, 10/8 and field trip on 9/20-21	0	0	0
Totals		**12**	**14**	**6**	**143**	**88**			**88**	**5**	**1711**		**32**	**244**		**129**	**10**	**15**			**48**	**59**	**31**

High Country Citizen Science Project
Mountain Goats and Bighorn Sheep

2013 Results:

- High Country citizen scientists contributed over 4,386 hours of survey effort, (2,857 hours for mountain goat/ bighorn sheep surveys and a total of for 1,529 hours pika surveys (1,177 hours for surveys at I & M pika sites and 352 hours for surveys at additional pika sites)
- Citizen scientists completed 176 mountain goat, 9 of these surveys were at unofficial sites
- Citizen scientists completed 79 pika surveys
- We conducted 14 training sessions (including outreach groups who conducted surveys) with 59 participants. We re-trained 12 returning citizen scientists during group surveys or one-on-one sessions.
- 126 citizen scientists conducted mountain goat/ bighorn sheep surveys
- 73 citizen scientists conducted pika surveys

Mountain goats and bighorn sheep

Mountain goats and bighorn sheep are counted during a one-hour observation period, and citizen scientists document number, sex and age of goats observed and behavior and habitat. Our goal is to survey each site at least three times per season; ideally once during Mountain Goat Days in mid-August, once before and once after. In 2013, citizen scientists completed least 2 surveys at all of the 37 mountain ungulate sites and 3 or more surveys at all but 3 sites (Upper Nyack, Janet Lake and Fifty Mountain- plans impacted by government shutdown).

In 2013 the Glacier National Park Citizen Science Project formed a partnership with the Greater Yellowstone Area Mountain Ungulate Project. The Greater Yellowstone Area Mountain Ungulate Project is a collaborative research effort that focuses on bighorn sheep and mountain goat ecology in the Yellowstone ecosystem. Mountain goats are considered a non-native species in the Greater Yellowstone Area, and their spread in distribution across the region has raised concerns regarding their potential impacts on native bighorn sheep. In contrast, Glacier National Park contains native populations of both bighorn sheep and mountain goats. Glacier National Park's setting provides an excellent opportunity to study natural distribution and sympatry of mountain ungulate species. Comparison of mountain ungulate data between native mountain goat range (Glacier National Park) and non-native range (Greater Yellowstone Area) could lead to significant ecological insight regarding mountain goat ecology and interaction with bighorn sheep in different settings.

Mountain Goat Days

With help from 33 volunteers that contributed over 428 hours, citizen scientists conducted an index count of mountain goat and bighorn sheep populations at representative sites throughout nearly the entire park between August 24th and 27th. In total, 82 goats (36 at survey sites during official survey periods and 36 outside of survey sites or outside of survey periods) were recorded. These index counts represent a snapshot of the population at representative sites from year to year, but do not represent a park-wide population estimate.

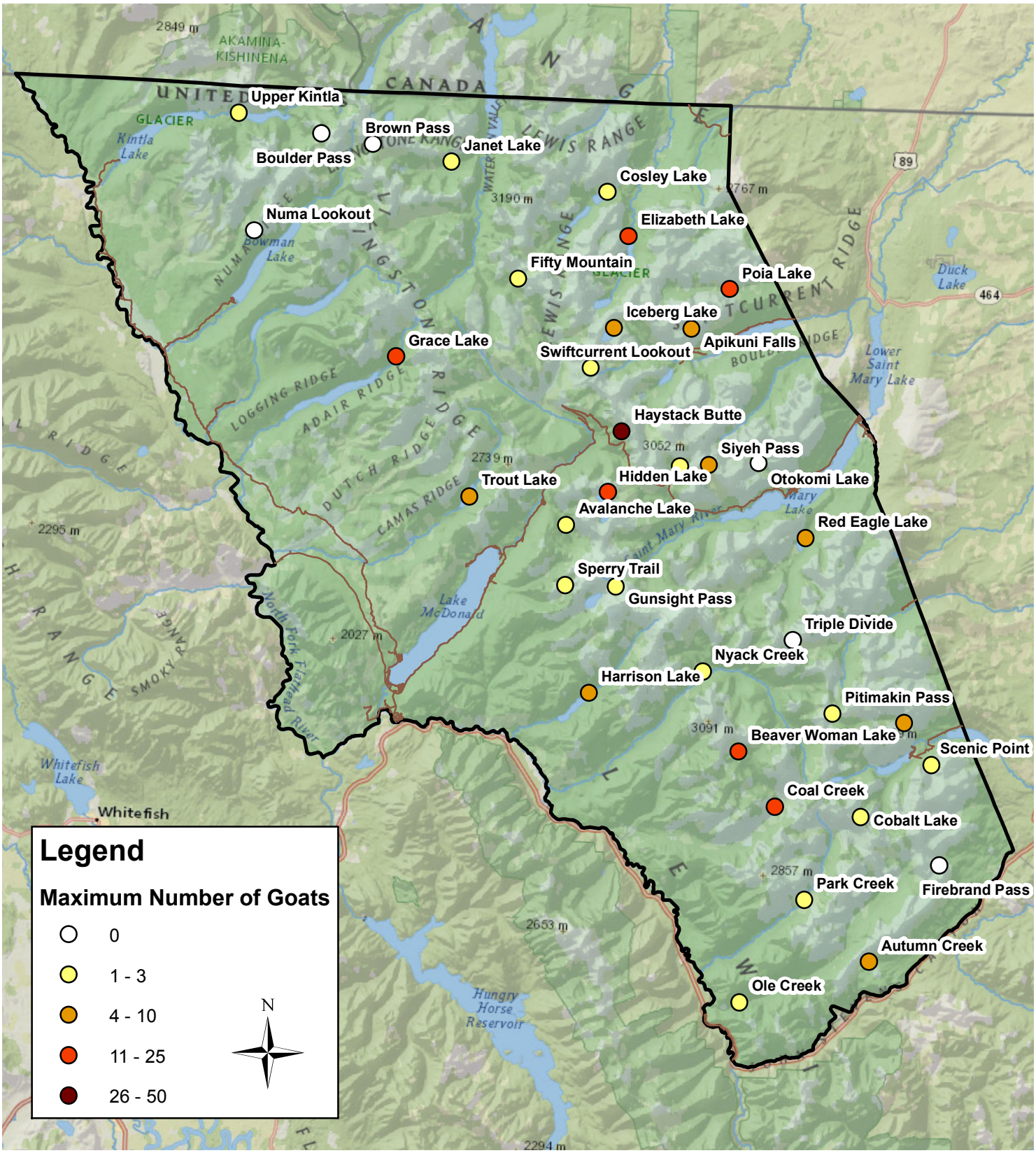
Year	Sites	Total Goats	Volunteers	Hours
2013	41	82	33	428

2012	34	118	27	414
2011	32	78	20	355
2010	36	155	31	585
2009	36	134	34	548
2008	34	151	46	414

Glacier National Park
Montana

National Park Service
U.S. Department of the Interior

Mountain Goat Results by Survey Site 2013



Produced by Glacier National Park Citizen Science Program

November 2013

FILE: Goat_Site_Maps_2013_SiteMap_Final.mxd

2013 Mountain Goat Days Summary

Goat Survey Site Name	Highest # of Goats	Highest # of Sheep	# of Goats Outside of Survey Time	# of Sheep Outside of Survey Time
Apikuni Falls	2	0	5	0
Autumn Creek	0	0	0	0
Avalanche Lake	0	0	0	0
Boulder Pass	0	0	0	0
Brown Pass	0	0	0	0
Cobalt Lake	2	0	1	0
Cosley Lake	2	0	4	0
Cut Bank Creek	0	0	0	0
Dry Fork Creek	0	0	0	0
Elizabeth Lake	0	0	0	0
Fifty Mountain	---	---	---	---
Firebrand Pass	0	0	0	0
Grace Lake	0	0	0	0
Gunsight Pass	0	0	6	0
Harrison Lake	0	0	0	0
Haystack Butte (Highline Trail)	5	1	1	3
Hidden Lake	4	0	5	1
Iceberg Lake	1	11	7	0
Janet Lake	1	0	0	3
Numa Lookout	---	---	---	---
Nyack Loop (Beaver Woman Lake)	11	0	0	0
Nyack Loop (Coal Creek)	1	0	0	0
Nyack Loop (Upper Nyack)	1	0	0	0
Ole Creek	0	0	0	0
Otokomi Lake	0	0	0	0
Park Creek	1	0	0	0
Pitimakin Pass	---	---	---	---
Poia Lake	0	0	0	5
Preston Park	2	0	2	0
Red Eagle Lake	0	0	0	0
Scenic Point	0	0	12	0
Siyeh Pass Loop	0	0	0	0
Sperry Chalet	3	0	3	0
Swiftcurrent Lookout	0	0	0	0
Triple Divide Pass	0	0	0	0
Trout Lake	0	0	0	0
Upper Kintla	0	0	0	0
TOTAL	**36**	**12**	**46**	**12**

<u>2013 Mountain Goat Days Totals</u>

41 total surveys completed as part of Goat Days

34 official sites surveyed, 3 official sites not surveyed, 1 unofficial site surveyed

33 volunteers participated

428 volunteer hours

50 Citizen Science staff hours

Glacier National Park and Greater Yellowstone Area Mountain Ungulate Collaboration Report 2013

Prepared by Glacier National Park Citizen Science project Staff, November 2013

INTRODUCTION

In 2013 the Glacier National Park Citizen Science Project formed a partnership with the Greater Yellowstone Area Mountain Ungulate Project. The Greater Yellowstone Area Mountain Ungulate Project is a collaborative research effort that focuses on bighorn sheep and mountain goat ecology in the Yellowstone ecosystem. Mountain goats are considered a non-native species in the Greater Yellowstone Area, and their spread in distribution across the region has raised concerns regarding their potential impacts on native bighorn sheep. In contrast, Glacier National Park contains native populations of both bighorn sheep and mountain goats. Glacier National Park's setting provides an excellent opportunity to study natural distribution and sympatry of mountain ungulate species. Comparison of mountain ungulate data between native mountain goat range (Glacier National Park) and non-native range (Greater Yellowstone Area) could lead to significant ecological insight regarding mountain goat ecology and interaction with bighorn sheep in different settings.

The Glacier National Park High Country Citizen Science project has collected mountain goat demographic and population trend data through ground-based monitoring at official survey sites since 2008. The Citizen Science project uses trained volunteers to collect mountain goat observations at monitoring sites and estimate population trends of the native mountain goat population within the park. For this project volunteers travel to high country sites accessible from trails to conduct systematic surveys for mountain goats within areas that contain both species of mountain ungulates. The Greater Yellowstone Area Mountain Ungulate Project's occupancy research initiative also involves systematic ground surveys for mountain ungulates, but surveys are conducted by biological science technicians in off-trail locations. In addition to mountain goat presence, Greater Yellowstone Area observers record bighorn sheep presence and UTM locations of mountain ungulate groups that are seen.

Both Glacier National Park and the Greater Yellowstone Area use occupancy analysis and n-mixture models to determine population size and monitor trend. Due to these preexisting similarities in survey format and research interests between the two projects, the Glacier Citizen Science project could potentially collect additional data to facilitate a cooperative research effort with the Greater Yellowstone Area Mountain Ungulate Project. The summer of 2013 served as a pilot year to initiate the necessary changes within the Citizen Science project for a cooperative effort and evaluate compatibility between these two research projects. The objectives of the Glacier Citizen Science project to facilitate this collaboration were to:

1. Modify citizen science survey protocol, volunteer training, and project database to accommodate bighorn sheep data collection;

2. Develop methods to accurately capture, store, and map UTM location data of mountain ungulates observed by volunteers and park staff;

3. Evaluate the quality of the mountain ungulate data collected and its compatibility with the Greater Yellowstone Area Mountain Ungulate Project for collaborative efforts in the future.

METHODS

Participants in Glacier National Park's High Country Citizen Science Project collected mountain ungulate data at 37 official survey sites that were visited by trained volunteers and park staff. (See Belt & Krausman 2012 for methods regarding site selection and survey protocol). Incidental mountain ungulate sightings along trails and roads were also recorded. Bighorn sheep were added to the survey protocol, data sheets, and new volunteer training. Returning citizen scientists were provided with resources regarding bighorn sheep identification, aging, and sexing in the field. For every bighorn sheep and mountain goat observation (incidental or during formal surveys), volunteers recorded total number, sex, age (young of year, yearling, or adult), predominant behavior upon detection (sitting, standing, feeding, walking, or other), and predominant landscape feature (snow/ice, ledge, loose rock, meadow, shrub/krummholz, forest, road, or trail). The citizen science database was modified to accommodate bighorn sheep observations.



Citizen scientists surveying for mountain ungulates at Avalanche Lake, Glacier National Park (NPS Photo).

In addition to adding bighorn sheep to the monitoring protocol, mountain ungulate location data (UTM coordinates) were recorded when possible. Recording accurate mountain ungulate locations can be challenging for volunteers, as it requires effective use of topographical maps and/or aerial photos. We asked only volunteers that had previous experience and a high comfort level with reading topographic maps to record mountain ungulate locations. Volunteers and staff accomplished this task through the use of hand-held GPS units, mobile mapping applications, the digital Glacier Wildlife Tracking map, and paper maps of survey sites (approximately 1:45,000 scale). The citizen science database was modified to accommodate UTM location data, and UTMs recorded by volunteers as digits were entered manually during data entry. Locations recorded on paper maps were digitized in ArcGIS and imported into the citizen science database. We entered and mapped only mountain ungulate location data that had fine spatial accuracy and were recorded by observers comfortable with topographic maps.

RESULTS

A total of 178 mountain ungulate surveys were completed by citizen scientists and park staff from May to October 2013. 441 mountain ungulate groups were observed during formal surveys, including 258 mountain goat and 183 bighorn sheep groups. 77 incidental mountain ungulate observations were also recorded, including 53 mountain goat and 24 bighorn sheep groups. Of the 518 total groups observed, UTM locations were recorded for 120 records (23%) (Mountain Ungulate Locations 2013 Map). UTMs were captured for 27 bighorn sheep and 93 mountain goat locations. Citizen science project park staff (Jami Belt and Elizabeth Flesch) recorded 52 mountain ungulate locations (43%). Nine different trained volunteer observer groups recorded 68 locations (57%).

DISCUSSION

The Glacier Citizen Science project was able to capture additional mountain ungulate data to facilitate collaboration with the Greater Yellowstone Area Mountain Ungulate Project, including bighorn sheep observations and mountain ungulate location data. Continuation of the new data collection methods will serve to further increase our understanding of mountain ungulates in Glacier National Park. For example, fine-scale occupancy analyses could potentially be performed in the future, since presence data are captured by citizen scientists and absence data could be extrapolated through viewshed analyses of official survey sites. The size of survey plots used in Glacier National Park is much larger than those used in the Greater Yellowstone Area, but we have discussed the possibility of merging grids in the GYA to make them comparable. In addition, with the assistance of the Greater Yellowstone Area Mountain Ungulate Project, we would like to evaluate the potential to compare these data with mountain ungulate survey data collected in the Greater Yellowstone Area.

WORKS CITED

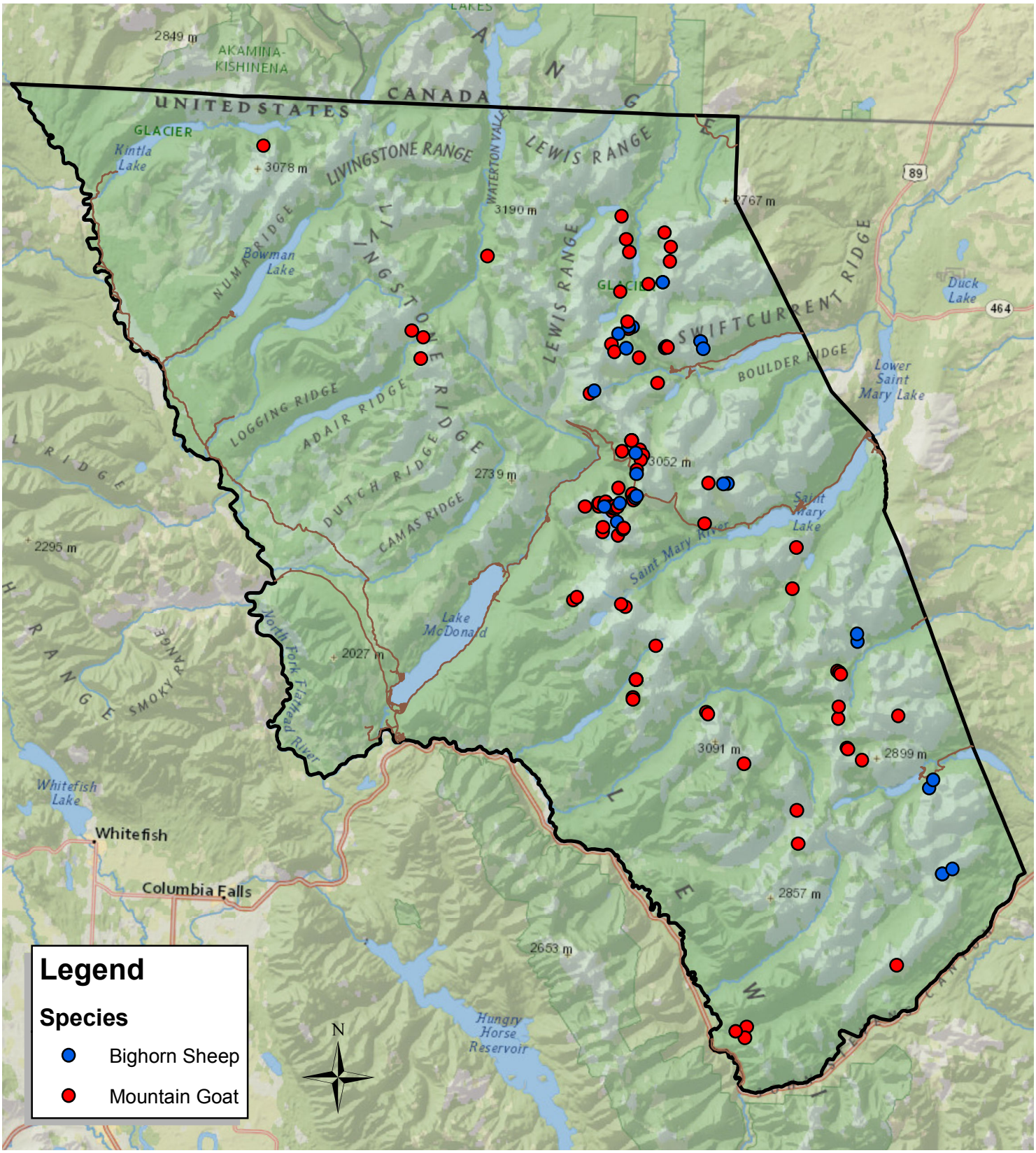
Belt, J.J. and P.R. Krausman. 2012. Evaluating population estimates of mountain goats based on citizen science. Wildlife Society Bulletin 36: 264-276.

O'Reilly, M. Using Occupancy Surveys to Assess Summer Resource Selection of Sympatric Bighorn Sheep and Mountain Goats in Northern Yellowstone. Greater Yellowstone Mountain Ungulate Project website, accessed 11/1/2013.

Glacier National Park
Montana

National Park Service
U.S. Department of the Interior

Mountain Ungulate Locations 2013



Produced by Glacier National Park Citizen Science Program

November 2013

FILE: Goat_Site_Maps_2013_Final.mxd

Goat Summary for year 2013

Site Name	Number of site visits	Number of Unknown (Sex or Age)	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total Goats	--	Maximum at Location
Apikuni Falls	5	0	17	1	0	5	3	1	22	--	9
Autumn Creek	5	2	11	5	0	1	1	0	14	--	5
Avalanche Lake	10	0	4	1	0	0	0	0	4	--	3
Beaver Woman Lake	3	2	9	0	6	6	2	0	17	--	11
Boulder Pass	5	0	0	0	0	0	0	0	0	--	0
Brown Pass	3	0	0	0	0	0	0	0	0	--	0
Coal Creek	3	0	12	1	2	2	0	0	14	--	11
Coal Creek (unofficial)	1	0	2	0	0	0	0	0	2	--	2
Cobalt Lake	4	0	2	0	0	0	0	0	2	--	2
Cosley Lake	4	0	4	1	0	1	0	1	5	--	2
Cut Bank Creek	5	0	0	0	0	0	0	0	0	--	0
Dry Fork Creek	5	1	6	0	0	0	0	0	7	--	5
Dry Fork Creek (unofficial)	2	0	3	0	1	1	1	0	4	--	4
Elizabeth Lake	5	6	20	0	8	6	6	0	32	--	14
Fifty Mountain	2	0	1	0	0	0	0	0	1	--	1
Firebrand Pass	4	0	0	0	0	0	0	0	0	--	0
Goat Lick Overlook	1	0	8	1	2	0	0	0	8	--	8
Grace Lake	3	11	0	0	0	0	0	0	11	--	11
Grinnell Lake	2	0	2	0	0	2	0	0	4	--	2
Gunsight Pass	2	0	1	0	0	0	0	0	1	--	1
Harrison Lake	5	0	6	0	0	4	4	0	10	--	9
Haystack Butte	5	23	31	0	4	22	15	4	76	--	30
Hidden Lake	12	9	48	8	14	23	14	7	80	--	17
Iceberg Lake	8	1	16	3	0	0	0	0	17	--	8
Janet Lake	2	1	0	0	0	0	0	0	1	--	1
Many Glacier Picnic	1	0	11	0	0	1	0	1	12	--	12
Numa Lookout	3	0	0	0	0	0	0	0	0	--	0
Ole Creek	6	0	3	0	0	0	0	0	3	--	3
Otokomi Lake	4	0	0	0	0	0	0	0	0	--	0
Park Creek	3	0	1	0	0	0	0	0	1	--	1
Pitamakin Pass	3	2	5	0	0	1	0	0	8	--	3
Poia Lake	4	5	16	0	10	5	1	4	26	--	16

Site Name	Number of site visits	Number of Unknown (Sex or Age)	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total Goats	--	Maximum at Location
Preston Park	5	1	2	0	0	0	0	0	3	--	2
Red Eagle Lake	3	0	8	0	0	1	0	1	9	--	5
Scenic Point	5	0	2	0	2	1	1	0	3	--	3
Siyeh Pass Loop	6	0	9	5	0	0	0	0	9	--	6
Sperry (alternative)	1	0	1	0	0	0	0	0	1	--	1
Sperry Chalet	4	0	1	0	0	2	1	1	3	--	3
Stoney Indian Lake (unofficial)	1	0	14	0	0	3	0	3	17	--	17
Swiftcurrent Lookout	3	0	2	0	0	0	0	0	2	--	2
Triple Divide Pass	3	0	0	0	0	0	0	0	0	--	0
Trout Lake	6	0	4	0	0	2	1	1	6	--	5
Upper Kintla	7	0	1	0	0	0	0	0	1	--	1
Upper Nyack	2	0	2	0	0	0	0	0	2	--	1
Grand Totals:	**176**	**64**	**285**	**26**	**49**	**89**	**50**	**24**	**438**		

Detailed Summary for Goat Surveys: Year 2013

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Apikuni Falls										
6/11/2013	No	CS - VIP	0	2	0	0	1	0	0	**3**
7/6/2013	No	CS	0	6	0	0	3	3	0	**9**
8/24/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/4/2013	No	CS - VIP	0	7	1	0	1	0	1	**8**
Summary for Apikuni Falls (5 site visits)										
		Sum	0	17	1	0	5	3	1	**22**
									Min	0
									Max	9
Autumn Creek										
6/10/2013	No	Bio Tech	2	2	0	0	0	0	0	**4**
6/24/2013	No	CS	0	5	5	0	0	0	0	**5**
7/9/2013	No	CS - VIP	0	4	0	0	1	1	0	**5**
7/16/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
Summary for Autumn Creek (5 site visits)										
		Sum	2	11	5	0	1	1	0	**14**
									Min	0
									Max	5
Avalanche Lake										
6/11/2013	No	CS - VIP	0	3	0	0	0	0	0	**3**
6/15/2013	No	CS	0	0	0	0	0	0	0	**0**
7/3/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
7/14/2013	No	CS	0	0	0	0	0	0	0	**0**
7/23/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
8/27/2013	No	CS	0	0	0	0	0	0	0	**0**
9/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/27/2013	No	CS	0	1	1	0	0	0	0	**1**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Avalanche Lake (10 site visits)										
		Sum	0	4	1	0	0	0	0	**4**
									Min	0
									Max	3
Beaver Woman Lake										
8/24/2013	No	CS - VIP	0	7	0	6	4	0	0	**11**
8/25/2013	No	CS - VIP	0	2	0	0	2	2	0	**4**
10/24/2013	No	CS	2	0	0	0	0	0	0	**2**
Summary for Beaver Woman Lake (3 site visits)										
		Sum	2	9	0	6	6	2	0	**17**
									Min	2
									Max	11
Boulder Pass										
8/10/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/13/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/26/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
9/14/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Boulder Pass (5 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Brown Pass										
8/10/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/25/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
9/14/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Brown Pass (3 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Coal Creek										
7/20/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
10/23/2013	No	CS	0	9	1	2	2	0	0	**11**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Coal Creek (3 site visits)										
		Sum	0	12	1	2	2	0	0	**14**
									Min	1
									Max	11
Coal Creek (unofficial)										
8/24/2013	No	CS	0	2	0	0	0	0	0	**2**
Summary for Coal Creek (unofficial) (1 site visit)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	2
									Max	2
Cobalt Lake										
7/12/2013	No	CS	0	0	0	0	0	0	0	**0**
8/1/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/23/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
Summary for Cobalt Lake (4 site visits)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	0
									Max	2
Cosley Lake										
6/18/2013	No	CS - VIP	0	2	0	0	0	0	0	**2**
7/23/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/7/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
8/24/2013	No	CS	0	1	1	0	1	0	1	**2**
Summary for Cosley Lake (4 site visits)										
		Sum	0	4	1	0	1	0	1	**5**
									Min	0
									Max	2
Cut Bank Creek										
6/20/2013	No	CS	0	0	0	0	0	0	0	**0**
6/21/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/2/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/16/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Cut Bank Creek (5 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Dry Fork Creek										
6/28/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/5/2013	No	CS - VIP	1	4	0	0	0	0	0	**5**
8/6/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/12/2013	No	CS - VIP	0	2	0	0	0	0	0	**2**
Summary for Dry Fork Creek (5 site visits)										
		Sum	1	6	0	0	0	0	0	**7**
									Min	0
									Max	5
Dry Fork Creek (unofficial)										
6/7/2013	No	Bio Tech	0	3	0	1	1	1	0	**4**
6/17/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
Summary for Dry Fork Creek (unofficial) (2 site visits)										
		Sum	0	3	0	1	1	1	0	**4**
									Min	0
									Max	4
Elizabeth Lake										
6/16/2013	No	CS - VIP	0	4	0	4	3	3	0	**7**
6/17/2013	No	CS - VIP	0	13	0	1	1	1	0	**14**
7/12/2013	No	CS	0	3	0	3	2	2	0	**5**
7/20/2013	No	CS	6	0	0	0	0	0	0	**6**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Elizabeth Lake (5 site visits)										
		Sum	6	20	0	8	6	6	0	**32**
									Min	0
									Max	14
Fifty Mountain										
8/18/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
9/8/2013	No	CS	0	1	0	0	0	0	0	**1**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Fifty Mountain (2 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Firebrand Pass										
7/4/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/9/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/15/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Firebrand Pass (4 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Goat Lick Overlook										
5/9/2013	No	CS	0	8	1	2	0	0	0	**8**
Summary for Goat Lick Overlook (1 site visit)										
		Sum	0	8	1	2	0	0	0	**8**
									Min	8
									Max	8
Grace Lake										
5/15/2013	No	CS	11	0	0	0	0	0	0	**11**
7/20/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Grace Lake (3 site visits)										
		Sum	11	0	0	0	0	0	0	**11**
									Min	0
									Max	11
Grinnell Lake										
9/20/2013	No	CS	0	1	0	0	1	0	0	**2**
9/21/2013	No	CS	0	1	0	0	1	0	0	**2**
Summary for Grinnell Lake (2 site visits)										
		Sum	0	2	0	0	2	0	0	**4**
									Min	2
									Max	2
Gunsight Pass										

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
8/15/2013	No	Bio Tech	0	1	0	0	0	0	0	**1**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Gunsight Pass (2 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Harrison Lake										
7/12/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/26/2013	No	CS	0	0	0	0	0	0	0	**0**
8/27/2013	No	CS	0	0	0	0	0	0	0	**0**
10/22/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
10/23/2013	No	CS - VIP	0	5	0	0	4	4	0	**9**
Summary for Harrison Lake (5 site visits)										
		Sum	0	6	0	0	4	4	0	**10**
									Min	0
									Max	9
Haystack Butte										
7/29/2013	No	Bio Tech	3	12	0	1	7	5	2	**22**
8/5/2013	No	CS - VIP	20	2	0	0	8	6	2	**30**
8/23/2013	No	CS	0	4	0	0	1	1	0	**5**
9/21/2013	No	CS	0	5	0	0	3	0	0	**8**
9/21/2013	No	CS	0	8	0	3	3	3	0	**11**
Summary for Haystack Butte (5 site visits)										
		Sum	23	31	0	4	22	15	4	**76**
									Min	5
									Max	30
Hidden Lake										
7/3/2013	No	CS - VIP	0	5	1	2	3	1	2	**8**
7/24/2013	No	CS	0	6	2	2	3	2	0	**9**
7/25/2013	No	CS - VIP	0	6	0	0	3	0	3	**9**
8/3/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS - VIP	1	2	1	1	1	0	1	**4**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
8/27/2013	No	CS	5	8	1	5	4	4	0	**17**
8/28/2013	No	CS	2	6	2	1	3	2	1	**11**
8/28/2013	No	Bio Tech	1	4	1	1	1	1	0	**6**
8/31/2013	No	CS	0	1	0	1	1	1	0	**2**
9/3/2013	No	CS	0	3	0	1	2	2	0	**5**
9/17/2013	No	Bio Tech	0	5	0	0	2	1	0	**7**
Summary for Hidden Lake (12 site visits)										
		Sum	9	48	8	14	23	14	7	**80**
									Min	0
									Max	17
Iceberg Lake										
6/27/2013	No	Bio Tech	0	1	0	0	0	0	0	**1**
6/27/2013	No	CS	0	8	0	0	0	0	0	**8**
8/25/2013	No	CS	0	1	1	0	0	0	0	**1**
9/2/2013	No	CS - VIP	0	1	1	0	0	0	0	**1**
9/21/2013	No	CS	1	0	0	0	0	0	0	**1**
9/21/2013	No	CS	0	1	1	0	0	0	0	**1**
9/21/2013	No	CS	0	2	0	0	0	0	0	**2**
9/21/2013	No	CS	0	2	0	0	0	0	0	**2**
Summary for Iceberg Lake (8 site visits)										
		Sum	1	16	3	0	0	0	0	**17**
									Min	1
									Max	8
Janet Lake										
7/21/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	1	0	0	0	0	0	0	**1**
Summary for Janet Lake (2 site visits)										
		Sum	1	0	0	0	0	0	0	**1**
									Min	0
									Max	1
Many Glacier Picnic										
5/6/2013	No	CS	0	11	0	0	1	0	1	**12**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Many Glacier Picnic (1 site visit)										
		Sum	0	11	0	0	1	0	1	**12**
									Min	12
									Max	12
Numa Lookout										
6/23/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/4/2013	No	CS	0	0	0	0	0	0	0	**0**
8/19/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Numa Lookout (3 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Ole Creek										
6/13/2013	No	CS	0	3	0	0	0	0	0	**3**
6/28/2013	No	CS	0	0	0	0	0	0	0	**0**
7/11/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/4/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/17/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Ole Creek (6 site visits)										
		Sum	0	3	0	0	0	0	0	**3**
									Min	0
									Max	3
Otokomi Lake										
7/16/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/19/2013	No	CS	0	0	0	0	0	0	0	**0**
8/20/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Otokomi Lake (4 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Park Creek										
7/1/2013	No	CS	0	0	0	0	0	0	0	**0**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
8/24/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
9/12/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
Summary for Park Creek (3 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Pitamakin Pass										
8/1/2013	No	CS	2	0	0	0	0	0	0	**2**
8/5/2013	No	CS - VIP	0	3	0	0	0	0	0	**3**
8/6/2013	No	CS - VIP	0	2	0	0	1	0	0	**3**
Summary for Pitamakin Pass (3 site visits)										
		Sum	2	5	0	0	1	0	0	**8**
									Min	2
									Max	3
Poia Lake										
6/11/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
7/14/2013	No	CS	3	10	0	10	3	0	3	**16**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/11/2013	No	CS - VIP	2	5	0	0	2	1	1	**9**
Summary for Poia Lake (4 site visits)										
		Sum	5	16	0	10	5	1	4	**26**
									Min	0
									Max	16
Preston Park										
6/29/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/9/2013	No	CS	0	0	0	0	0	0	0	**0**
7/14/2013	No	CS	1	0	0	0	0	0	0	**1**
7/30/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS - VIP	0	2	0	0	0	0	0	**2**
Summary for Preston Park (5 site visits)										
		Sum	1	2	0	0	0	0	0	**3**
									Min	0
									Max	2
Red Eagle Lake										

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
5/18/2013	No	CS - VIP	0	5	0	0	0	0	0	**5**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/15/2013	No	CS - VIP	0	3	0	0	1	0	1	**4**
Summary for Red Eagle Lake (3 site visits)										
		Sum	0	8	0	0	1	0	1	**9**
									Min	0
									Max	5
Scenic Point										
6/17/2013	No	CS - VIP	0	2	0	2	1	1	0	**3**
6/18/2013	No	CS	0	0	0	0	0	0	0	**0**
7/22/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
8/26/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Scenic Point (5 site visits)										
		Sum	0	2	0	2	1	1	0	**3**
									Min	0
									Max	3
Siyeh Pass Loop										
7/9/2013	No	CS	0	1	1	0	0	0	0	**1**
7/14/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/30/2013	No	CS	0	1	0	0	0	0	0	**1**
8/7/2013	No	Bio Tech	0	1	0	0	0	0	0	**1**
8/27/2013	No	CS	0	0	0	0	0	0	0	**0**
8/30/2013	No	CS - VIP	0	6	4	0	0	0	0	**6**
Summary for Siyeh Pass Loop (6 site visits)										
		Sum	0	9	5	0	0	0	0	**9**
									Min	0
									Max	6
Sperry (alternative)										
7/11/2013	No	CS	0	1	0	0	0	0	0	**1**
Summary for Sperry (alternative) (1 site visit)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	1
									Max	1

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Sperry Chalet										
7/23/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	1	0	0	2	1	1	**3**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/4/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Sperry Chalet (4 site visits)										
		Sum	0	1	0	0	2	1	1	**3**
									Min	0
									Max	3
Stoney Indian Lake (unofficial)										
8/5/2013	No	CS - VIP	0	14	0	0	3	0	3	**17**
Summary for Stoney Indian Lake (unofficial) (1 site visit)										
		Sum	0	14	0	0	3	0	3	**17**
									Min	17
									Max	17
Swiftcurrent Lookout										
8/16/2013	No	CS	0	2	0	0	0	0	0	**2**
8/20/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Swiftcurrent Lookout (3 site visits)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	0
									Max	2
Triple Divide Pass										
7/31/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/16/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
Summary for Triple Divide Pass (3 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Trout Lake										
6/12/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/10/2013	No	CS	0	3	0	0	2	1	1	**5**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
7/12/2013	No	CS	0	1	0	0	0	0	0	**1**
7/21/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/17/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Trout Lake (6 site visits)										
		Sum	0	4	0	0	2	1	1	**6**
									Min	0
									Max	5
Upper Kintla										
7/9/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/10/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
8/8/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/24/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
9/13/2013	No	CS	0	0	0	0	0	0	0	**0**
9/14/2013	No	CS	0	0	0	0	0	0	0	**0**
9/19/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Upper Kintla (7 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Upper Nyack										
8/23/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
10/23/2013	No	CS	0	1	0	0	0	0	0	**1**
Summary for Upper Nyack (2 site visits)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	1
									Max	1
		Grand Total	64	285	26	49	89	50	24	**438**

Sheep Summary for year 2013

Site Name	Number of site visits	Number of Unknown (Sex or Age)	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total Sheep	--	Maximum at Location
Apikuni Falls	5	0	10	0	0	12	2	0	22	--	22
Autumn Creek	5	0	0	0	0	0	0	0	0	--	0
Avalanche Lake	10	0	0	0	0	0	0	0	0	--	0
Beaver Woman Lake	3	0	0	0	0	0	0	0	0	--	0
Boulder Pass	5	0	0	0	0	0	0	0	0	--	0
Brown Pass	3	0	0	0	0	0	0	0	0	--	0
Coal Creek	3	0	0	0	0	0	0	0	0	--	0
Cobalt Lake	4	0	0	0	0	0	0	0	0	--	0
Cosley Lake	4	0	0	0	0	0	0	0	0	--	0
Cut Bank Creek	5	0	5	0	5	5	3	2	10	--	10
Dry Fork Creek	5	0	0	0	0	0	0	0	0	--	0
Dry Fork Creek (unofficial)	2	0	0	0	0	0	0	0	0	--	0
Elizabeth Lake	5	0	10	0	0	2	2	0	12	--	12
Fifty Mountain	2	0	0	0	0	0	0	0	0	--	0
Firebrand Pass	4	0	10	2	0	2	0	2	12	--	12
Grace Lake	3	0	0	0	0	0	0	0	0	--	0
Grinnell Lake	2	0	0	0	0	0	0	0	0	--	0
Gunsight Pass	2	0	0	0	0	0	0	0	0	--	0
Harrison Lake	5	0	0	0	0	0	0	0	0	--	0
Haystack Butte	5	0	1	1	0	0	0	0	1	--	1
Hidden Lake	12	0	5	1	0	0	0	0	5	--	4
Iceberg Lake	8	51	74	13	27	27	19	2	152	--	52
Janet Lake	2	0	0	0	0	0	0	0	0	--	0
Many Glacier Picnic	1	65	0	0	0	0	0	0	65	--	65
Numa Lookout	3	0	0	0	0	0	0	0	0	--	0
Ole Creek	6	0	0	0	0	0	0	0	0	--	0
Otokomi Lake	4	0	0	0	0	0	0	0	0	--	0
Park Creek	3	0	0	0	0	0	0	0	0	--	0
Pitamakin Pass	3	0	6	0	1	1	1	0	7	--	7
Poia Lake	4	0	5	0	0	5	0	5	10	--	10
Preston Park	5	0	0	0	0	0	0	0	0	--	0
Red Eagle Lake	3	0	2	0	0	0	0	0	2	--	2

Site Name	Number of site visits	Number of Unknown (Sex or Age)	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total Sheep	--	Maximum at Location
Scenic Point	5	0	4	0	2	4	3	1	8	--	8
Siyeh Pass Loop	6	0	13	0	13	8	7	1	21	--	9
Sperry (alternative)	1	0	0	0	0	0	0	0	0	--	0
Sperry Chalet	4	0	0	0	0	0	0	0	0	--	0
Stoney Indian Lake (unofficial)	1	0	0	0	0	0	0	0	0	--	0
Swiftcurrent Lookout	3	0	0	0	0	0	0	0	0	--	0
Triple Divide Pass	3	0	0	0	0	0	0	0	0	--	0
Trout Lake	6	0	0	0	0	0	0	0	0	--	0
Upper Kintla	7	0	0	0	0	0	0	0	0	--	0
Upper Nyack	2	0	0	0	0	0	0	0	0	--	0
Grand Totals:	**174**	**116**	**145**	**17**	**48**	**66**	**37**	**13**	**327**		

Detailed Summary for Goat Surveys: Year 2013

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Apikuni Falls										
6/11/2013	No	CS - VIP	0	2	0	0	1	0	0	**3**
7/6/2013	No	CS	0	6	0	0	3	3	0	**9**
8/24/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/4/2013	No	CS - VIP	0	7	1	0	1	0	1	**8**
Summary for Apikuni Falls (5 site visits)										
		Sum	0	17	1	0	5	3	1	**22**
									Min	0
									Max	9
Autumn Creek										
6/10/2013	No	Bio Tech	2	2	0	0	0	0	0	**4**
6/24/2013	No	CS	0	5	5	0	0	0	0	**5**
7/9/2013	No	CS - VIP	0	4	0	0	1	1	0	**5**
7/16/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
Summary for Autumn Creek (5 site visits)										
		Sum	2	11	5	0	1	1	0	**14**
									Min	0
									Max	5
Avalanche Lake										
6/11/2013	No	CS - VIP	0	3	0	0	0	0	0	**3**
6/15/2013	No	CS	0	0	0	0	0	0	0	**0**
7/3/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
7/14/2013	No	CS	0	0	0	0	0	0	0	**0**
7/23/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
8/27/2013	No	CS	0	0	0	0	0	0	0	**0**
9/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/27/2013	No	CS	0	1	1	0	0	0	0	**1**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Avalanche Lake (10 site visits)										
		Sum	0	4	1	0	0	0	0	**4**
									Min	0
									Max	3
Beaver Woman Lake										
8/24/2013	No	CS - VIP	0	7	0	6	4	0	0	**11**
8/25/2013	No	CS - VIP	0	2	0	0	2	2	0	**4**
10/24/2013	No	CS	2	0	0	0	0	0	0	**2**
Summary for Beaver Woman Lake (3 site visits)										
		Sum	2	9	0	6	6	2	0	**17**
									Min	2
									Max	11
Boulder Pass										
8/10/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/13/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/26/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
9/14/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Boulder Pass (5 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Brown Pass										
8/10/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/25/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
9/14/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Brown Pass (3 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Coal Creek										
7/20/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
10/23/2013	No	CS	0	9	1	2	2	0	0	**11**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Coal Creek (3 site visits)										
		Sum	0	12	1	2	2	0	0	**14**
									Min	1
									Max	11
Coal Creek (unofficial)										
8/24/2013	No	CS	0	2	0	0	0	0	0	**2**
Summary for Coal Creek (unofficial) (1 site visit)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	2
									Max	2
Cobalt Lake										
7/12/2013	No	CS	0	0	0	0	0	0	0	**0**
8/1/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/23/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
Summary for Cobalt Lake (4 site visits)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	0
									Max	2
Cosley Lake										
6/18/2013	No	CS - VIP	0	2	0	0	0	0	0	**2**
7/23/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/7/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
8/24/2013	No	CS	0	1	1	0	1	0	1	**2**
Summary for Cosley Lake (4 site visits)										
		Sum	0	4	1	0	1	0	1	**5**
									Min	0
									Max	2
Cut Bank Creek										
6/20/2013	No	CS	0	0	0	0	0	0	0	**0**
6/21/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/2/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/16/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Cut Bank Creek (5 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Dry Fork Creek										
6/28/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/5/2013	No	CS - VIP	1	4	0	0	0	0	0	**5**
8/6/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/12/2013	No	CS - VIP	0	2	0	0	0	0	0	**2**
Summary for Dry Fork Creek (5 site visits)										
		Sum	1	6	0	0	0	0	0	**7**
									Min	0
									Max	5
Dry Fork Creek (unofficial)										
6/7/2013	No	Bio Tech	0	3	0	1	1	1	0	**4**
6/17/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
Summary for Dry Fork Creek (unofficial) (2 site visits)										
		Sum	0	3	0	1	1	1	0	**4**
									Min	0
									Max	4
Elizabeth Lake										
6/16/2013	No	CS - VIP	0	4	0	4	3	3	0	**7**
6/17/2013	No	CS - VIP	0	13	0	1	1	1	0	**14**
7/12/2013	No	CS	0	3	0	3	2	2	0	**5**
7/20/2013	No	CS	6	0	0	0	0	0	0	**6**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Elizabeth Lake (5 site visits)										
		Sum	6	20	0	8	6	6	0	**32**
									Min	0
									Max	14
Fifty Mountain										
8/18/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
9/8/2013	No	CS	0	1	0	0	0	0	0	**1**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Fifty Mountain (2 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Firebrand Pass										
7/4/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/9/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/15/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Firebrand Pass (4 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Goat Lick Overlook										
5/9/2013	No	CS	0	8	1	2	0	0	0	**8**
Summary for Goat Lick Overlook (1 site visit)										
		Sum	0	8	1	2	0	0	0	**8**
									Min	8
									Max	8
Grace Lake										
5/15/2013	No	CS	11	0	0	0	0	0	0	**11**
7/20/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Grace Lake (3 site visits)										
		Sum	11	0	0	0	0	0	0	**11**
									Min	0
									Max	11
Grinnell Lake										
9/20/2013	No	CS	0	1	0	0	1	0	0	**2**
9/21/2013	No	CS	0	1	0	0	1	0	0	**2**
Summary for Grinnell Lake (2 site visits)										
		Sum	0	2	0	0	2	0	0	**4**
									Min	2
									Max	2
Gunsight Pass										

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
8/15/2013	No	Bio Tech	0	1	0	0	0	0	0	**1**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Gunsight Pass (2 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Harrison Lake										
7/12/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/26/2013	No	CS	0	0	0	0	0	0	0	**0**
8/27/2013	No	CS	0	0	0	0	0	0	0	**0**
10/22/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
10/23/2013	No	CS - VIP	0	5	0	0	4	4	0	**9**
Summary for Harrison Lake (5 site visits)										
		Sum	0	6	0	0	4	4	0	**10**
									Min	0
									Max	9
Haystack Butte										
7/29/2013	No	Bio Tech	3	12	0	1	7	5	2	**22**
8/5/2013	No	CS - VIP	20	2	0	0	8	6	2	**30**
8/23/2013	No	CS	0	4	0	0	1	1	0	**5**
9/21/2013	No	CS	0	5	0	0	3	0	0	**8**
9/21/2013	No	CS	0	8	0	3	3	3	0	**11**
Summary for Haystack Butte (5 site visits)										
		Sum	23	31	0	4	22	15	4	**76**
									Min	5
									Max	30
Hidden Lake										
7/3/2013	No	CS - VIP	0	5	1	2	3	1	2	**8**
7/24/2013	No	CS	0	6	2	2	3	2	0	**9**
7/25/2013	No	CS - VIP	0	6	0	0	3	0	3	**9**
8/3/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	2	0	0	0	0	0	**2**
8/25/2013	No	CS - VIP	1	2	1	1	1	0	1	**4**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
8/27/2013	No	CS	5	8	1	5	4	4	0	**17**
8/28/2013	No	CS	2	6	2	1	3	2	1	**11**
8/28/2013	No	Bio Tech	1	4	1	1	1	1	0	**6**
8/31/2013	No	CS	0	1	0	1	1	1	0	**2**
9/3/2013	No	CS	0	3	0	1	2	2	0	**5**
9/17/2013	No	Bio Tech	0	5	0	0	2	1	0	**7**
Summary for Hidden Lake (12 site visits)										
		Sum	9	48	8	14	23	14	7	**80**
									Min	0
									Max	17
Iceberg Lake										
6/27/2013	No	Bio Tech	0	1	0	0	0	0	0	**1**
6/27/2013	No	CS	0	8	0	0	0	0	0	**8**
8/25/2013	No	CS	0	1	1	0	0	0	0	**1**
9/2/2013	No	CS - VIP	0	1	1	0	0	0	0	**1**
9/21/2013	No	CS	1	0	0	0	0	0	0	**1**
9/21/2013	No	CS	0	1	1	0	0	0	0	**1**
9/21/2013	No	CS	0	2	0	0	0	0	0	**2**
9/21/2013	No	CS	0	2	0	0	0	0	0	**2**
Summary for Iceberg Lake (8 site visits)										
		Sum	1	16	3	0	0	0	0	**17**
									Min	1
									Max	8
Janet Lake										
7/21/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	1	0	0	0	0	0	0	**1**
Summary for Janet Lake (2 site visits)										
		Sum	1	0	0	0	0	0	0	**1**
									Min	0
									Max	1
Many Glacier Picnic										
5/6/2013	No	CS	0	11	0	0	1	0	1	**12**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Summary for Many Glacier Picnic (1 site visit)										
		Sum	0	11	0	0	1	0	1	**12**
									Min	12
									Max	12
Numa Lookout										
6/23/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/4/2013	No	CS	0	0	0	0	0	0	0	**0**
8/19/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Numa Lookout (3 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Ole Creek										
6/13/2013	No	CS	0	3	0	0	0	0	0	**3**
6/28/2013	No	CS	0	0	0	0	0	0	0	**0**
7/11/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/4/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/17/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Ole Creek (6 site visits)										
		Sum	0	3	0	0	0	0	0	**3**
									Min	0
									Max	3
Otokomi Lake										
7/16/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/19/2013	No	CS	0	0	0	0	0	0	0	**0**
8/20/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Otokomi Lake (4 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Park Creek										
7/1/2013	No	CS	0	0	0	0	0	0	0	**0**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
8/24/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
9/12/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
Summary for Park Creek (3 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Pitamakin Pass										
8/1/2013	No	CS	2	0	0	0	0	0	0	**2**
8/5/2013	No	CS - VIP	0	3	0	0	0	0	0	**3**
8/6/2013	No	CS - VIP	0	2	0	0	1	0	0	**3**
Summary for Pitamakin Pass (3 site visits)										
		Sum	2	5	0	0	1	0	0	**8**
									Min	2
									Max	3
Poia Lake										
6/11/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
7/14/2013	No	CS	3	10	0	10	3	0	3	**16**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/11/2013	No	CS - VIP	2	5	0	0	2	1	1	**9**
Summary for Poia Lake (4 site visits)										
		Sum	5	16	0	10	5	1	4	**26**
									Min	0
									Max	16
Preston Park										
6/29/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/9/2013	No	CS	0	0	0	0	0	0	0	**0**
7/14/2013	No	CS	1	0	0	0	0	0	0	**1**
7/30/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS - VIP	0	2	0	0	0	0	0	**2**
Summary for Preston Park (5 site visits)										
		Sum	1	2	0	0	0	0	0	**3**
									Min	0
									Max	2
Red Eagle Lake										

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
5/18/2013	No	CS - VIP	0	5	0	0	0	0	0	**5**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/15/2013	No	CS - VIP	0	3	0	0	1	0	1	**4**
Summary for Red Eagle Lake (3 site visits)										
		Sum	0	8	0	0	1	0	1	**9**
									Min	0
									Max	5
Scenic Point										
6/17/2013	No	CS - VIP	0	2	0	2	1	1	0	**3**
6/18/2013	No	CS	0	0	0	0	0	0	0	**0**
7/22/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
8/26/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Scenic Point (5 site visits)										
		Sum	0	2	0	2	1	1	0	**3**
									Min	0
									Max	3
Siyeh Pass Loop										
7/9/2013	No	CS	0	1	1	0	0	0	0	**1**
7/14/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/30/2013	No	CS	0	1	0	0	0	0	0	**1**
8/7/2013	No	Bio Tech	0	1	0	0	0	0	0	**1**
8/27/2013	No	CS	0	0	0	0	0	0	0	**0**
8/30/2013	No	CS - VIP	0	6	4	0	0	0	0	**6**
Summary for Siyeh Pass Loop (6 site visits)										
		Sum	0	9	5	0	0	0	0	**9**
									Min	0
									Max	6
Sperry (alternative)										
7/11/2013	No	CS	0	1	0	0	0	0	0	**1**
Summary for Sperry (alternative) (1 site visit)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	1
									Max	1

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
Sperry Chalet										
7/23/2013	No	CS	0	0	0	0	0	0	0	**0**
8/25/2013	No	CS	0	1	0	0	2	1	1	**3**
8/25/2013	No	CS	0	0	0	0	0	0	0	**0**
9/4/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Sperry Chalet (4 site visits)										
		Sum	0	1	0	0	2	1	1	**3**
									Min	0
									Max	3
Stoney Indian Lake (unofficial)										
8/5/2013	No	CS - VIP	0	14	0	0	3	0	3	**17**
Summary for Stoney Indian Lake (unofficial) (1 site visit)										
		Sum	0	14	0	0	3	0	3	**17**
									Min	17
									Max	17
Swiftcurrent Lookout										
8/16/2013	No	CS	0	2	0	0	0	0	0	**2**
8/20/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Swiftcurrent Lookout (3 site visits)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	0
									Max	2
Triple Divide Pass										
7/31/2013	No	CS	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/16/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
Summary for Triple Divide Pass (3 site visits)										
		Sum	0	0	0	0	0	0	0	**0**
									Min	0
									Max	0
Trout Lake										
6/12/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/10/2013	No	CS	0	3	0	0	2	1	1	**5**

Survey Date	Paired Observation?	Most Experienced Observer	Number of Unknown	Number of Adults	Males	Females	Number of Young	Young of Year	Yearling	Total
7/12/2013	No	CS	0	1	0	0	0	0	0	**1**
7/21/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
8/24/2013	No	CS	0	0	0	0	0	0	0	**0**
9/17/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Trout Lake (6 site visits)										
		Sum	0	4	0	0	2	1	1	**6**
									Min	0
									Max	5
Upper Kintla										
7/9/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
7/10/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
8/8/2013	No	CS - VIP	0	0	0	0	0	0	0	**0**
8/24/2013	No	Bio Tech	0	0	0	0	0	0	0	**0**
9/13/2013	No	CS	0	0	0	0	0	0	0	**0**
9/14/2013	No	CS	0	0	0	0	0	0	0	**0**
9/19/2013	No	CS	0	0	0	0	0	0	0	**0**
Summary for Upper Kintla (7 site visits)										
		Sum	0	1	0	0	0	0	0	**1**
									Min	0
									Max	1
Upper Nyack										
8/23/2013	No	CS - VIP	0	1	0	0	0	0	0	**1**
10/23/2013	No	CS	0	1	0	0	0	0	0	**1**
Summary for Upper Nyack (2 site visits)										
		Sum	0	2	0	0	0	0	0	**2**
									Min	1
									Max	1
		Grand Total	64	285	26	49	89	50	24	**438**

Mountain Goat/ Bighorn Sheep
Volunteer Hours

Goat_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
1083	Apikuni Falls	6/11/2013	4	7:30	21:30	14.00	56.00
1084	Apikuni Falls	7/6/2013	2	7:45	14:45	7.00	14.00
1171	Apikuni Falls	8/24/2013	2	7:00	21:00	14.00	28.00
1172	Apikuni Falls	8/25/2013	1	9:00	15:30	6.50	6.50
1141	Apikuni Falls	9/4/2013	1	7:00	17:20	10.33	10.33
1144	Autumn Creek	6/10/2013	10	9:15	17:30	8.25	82.50
1246	Autumn Creek	6/24/2013	1	13:00	18:00	5.00	5.00
1089	Autumn Creek	7/9/2013	1	7:00	10:50	3.83	3.83
1090	Autumn Creek	7/16/2013	2	10:00	17:00	7.00	14.00
1173	Autumn Creek	8/25/2013	1	6:00	13:00	7.00	7.00
1088	Avalanche Lake	6/11/2013	2	7:30	11:07	3.62	7.23
1087	Avalanche Lake	6/15/2013	2	13:00	18:00	5.00	10.00
1086	Avalanche Lake	7/3/2013	5	11:30	17:30	6.00	30.00
1142	Avalanche Lake	7/14/2013	2	16:30	22:30	6.00	12.00
1085	Avalanche Lake	7/23/2013	1	17:00	19:45	2.75	2.75
1174	Avalanche Lake	8/24/2013	1	8:37	15:30	6.88	6.88
1223	Avalanche Lake	8/25/2013	2	6:00	13:00	7.00	14.00
1220	Avalanche Lake	8/27/2013	5	9:05	16:30	7.42	37.08
1238	Avalanche Lake	9/24/2013	2	11:30	17:00	5.50	11.00
1243	Avalanche Lake	9/27/2013	1	8:00	15:00	7.00	7.00
1194	Beaver Woman Lake	8/24/2013	1	8:00	21:00	13.00	13.00
1195	Beaver Woman Lake	8/25/2013	1	7:00	19:00	12.00	12.00
1252	Beaver Woman Lake	10/24/2013	1	7:00	13:00	6.00	6.00
1147	Boulder Pass	8/10/2013	1	6:50	19:10	12.33	12.33
1145	Boulder Pass	8/13/2013	1	9:30	13:50	4.33	4.33
1175	Boulder Pass	8/25/2013	1	7:50	19:10	11.33	11.33
1176	Boulder Pass	8/26/2013	1	8:00	17:00	9.00	9.00
1209	Boulder Pass	9/14/2013	2	9:15	20:00	10.75	21.50
1148	Brown Pass	8/10/2013	1	6:50	19:10	12.33	12.33
1177	Brown Pass	8/25/2013	1	7:50	19:10	11.33	11.33
1208	Brown Pass	9/14/2013	2	9:15	20:00	10.75	21.50
1231	Coal Creek	7/20/2013	2	17:00	17:10	0.17	0.34
1196	Coal Creek	8/25/2013	1	7:00	18:00	11.00	11.00
1253	Coal Creek	10/23/2013	1	14:00	20:00	6.00	6.00
1232	Coal Creek (unofficial)	8/24/2013	2	13:00	13:10	0.17	0.34
1091	Cobalt Lake	7/12/2013	1	10:00	19:00	9.00	9.00
1111	Cobalt Lake	8/1/2013	1	15:00	23:59	8.98	8.98
1178	Cobalt Lake	8/23/2013	1	6:10	20:00	13.83	13.83
1179	Cobalt Lake	8/25/2013	1	10:00	18:45	8.75	8.75
1093	Cosley Lake	6/18/2013	1	9:00	18:45	9.75	9.75
1092	Cosley Lake	7/23/2013	1	8:00	18:00	10.00	10.00
1146	Cosley Lake	8/7/2013	1	18:15	21:00	2.75	2.75
1180	Cosley Lake	8/24/2013	2	10:00	11:00	1.00	2.00

Mountain Goat/ Bighorn Sheep
Volunteer Hours

Goat_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
1094	Cut Bank Creek	6/20/2013	2	10:00	16:30	6.50	13.00
1081	Cut Bank Creek	6/21/2013	1	8:00	16:15	8.25	8.25
1112	Cut Bank Creek	8/2/2013	3	7:00	13:35	6.58	19.75
1181	Cut Bank Creek	8/24/2013	1	9:20	13:05	3.75	3.75
1233	Cut Bank Creek	9/16/2013	1	8:30	19:00	10.50	10.50
1095	Dry Fork Creek	6/28/2013	17	11:30	17:15	5.75	97.75
1150	Dry Fork Creek	8/5/2013	1	8:45	19:00	10.25	10.25
1149	Dry Fork Creek	8/6/2013	2	10:00	17:30	7.50	15.00
1182	Dry Fork Creek	8/25/2013	1	8:20	15:45	7.42	7.42
1210	Dry Fork Creek	9/12/2013	1	6:30	17:30	11.00	11.00
1219	Dry Fork Creek (unofficial)	6/7/2013	8	8:30	18:30	10.00	80.00
1139	Dry Fork Creek (unofficial)	6/17/2013	11	10:15	18:30	8.25	90.75
1097	Elizabeth Lake	6/16/2013	1	8:00	20:00	12.00	12.00
1098	Elizabeth Lake	6/17/2013	1	6:30	19:30	13.00	13.00
1251	Elizabeth Lake	7/12/2013	1	8:00	18:00	10.00	10.00
1096	Elizabeth Lake	7/20/2013	2	7:00	20:30	13.50	27.00
1151	Elizabeth Lake	8/8/2013	1	7:00	13:30	6.50	6.50
1183	Elizabeth Lake	8/24/2013	1	12:00	23:59	11.98	11.98
1152	Fifty Mountain	8/18/2013	1	8:00	16:35	8.58	8.58
1211	Fifty Mountain	9/8/2013	2	16:00	20:00	4.00	8.00
1100	Firebrand Pass	7/4/2013	1	7:30	16:00	8.50	8.50
1099	Firebrand Pass	7/9/2013	1	8:00	18:00	10.00	10.00
1229	Firebrand Pass	8/15/2013	7	8:00	18:30	10.50	73.50
1184	Firebrand Pass	8/25/2013	1	7:00	15:30	8.50	8.50
1101	Goat Lick Overlook	5/9/2013	1	9:00	15:00	6.00	6.00
1102	Grace Lake	5/15/2013	1	11:00	17:00	6.00	6.00
1103	Grace Lake	7/20/2013	1	7:30	20:00	12.50	12.50
1185	Grace Lake	8/24/2013	1	0:00	23:59	23.98	23.98
1244	Grinnell Lake	9/20/2013	2	17:12	18:00	0.80	1.60
1245	Grinnell Lake	9/21/2013	2	17:11	19:30	2.32	4.63
1153	Gunsight Pass	8/15/2013	1	7:30	18:30	11.00	11.00
1186	Gunsight Pass	8/24/2013	1	7:15	15:00	7.75	7.75
1104	Harrison Lake	7/12/2013	1	7:00	19:00	12.00	12.00
1187	Harrison Lake	8/26/2013	2	9:00	19:45	10.75	21.50
1188	Harrison Lake	8/27/2013	2	9:00	19:45	10.75	21.50
1255	Harrison Lake	10/22/2013	1	9:45	18:45	9.00	9.00
1256	Harrison Lake	10/23/2013	1	10:00	18:45	8.75	8.75
1105	Haystack Butte	7/29/2013	8	10:00	19:00	9.00	72.00
1118	Haystack Butte	8/5/2013	1	5:00	15:30	10.50	10.50
1189	Haystack Butte	8/23/2013	1	6:00	16:45	10.75	10.75
1230	Haystack Butte	9/21/2013	1	10:30	17:00	6.50	6.50
1234	Haystack Butte	9/21/2013	2	7:30	18:00	10.50	21.00

Mountain Goat/ Bighorn Sheep
Volunteer Hours

Goat_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
1107	Hidden Lake	7/3/2013	1	9:00	17:40	8.67	8.67
1106	Hidden Lake	7/24/2013	1	8:45	16:10	7.42	7.42
1154	Hidden Lake	7/25/2013	1	10:00	16:00	6.00	6.00
1138	Hidden Lake	8/3/2013	2	7:00	13:40	6.67	13.33
1190	Hidden Lake	8/24/2013	1	7:00	19:00	12.00	12.00
1191	Hidden Lake	8/25/2013	1	6:30	14:25	7.92	7.92
1155	Hidden Lake	8/27/2013	1	4:30	18:00	13.50	13.50
1156	Hidden Lake	8/28/2013	1	4:30	15:30	11.00	11.00
1221	Hidden Lake	8/28/2013	2	8:20	15:30	7.17	14.33
1157	Hidden Lake	8/31/2013	2	6:45	10:15	3.50	7.00
1158	Hidden Lake	9/3/2013	1	7:15	16:30	9.25	9.25
1212	Hidden Lake	9/17/2013	3	7:00	15:00	8.00	24.00
1082	Iceberg Lake	6/27/2013	1	7:30	17:30	10.00	10.00
1108	Iceberg Lake	6/27/2013	2	9:30	19:45	10.25	20.50
1192	Iceberg Lake	8/25/2013	2	11:05	22:00	10.92	21.83
1159	Iceberg Lake	9/2/2013	1	7:30	18:30	11.00	11.00
1242	Iceberg Lake	9/21/2013	2	9:15	15:45	6.50	13.00
1241	Iceberg Lake	9/21/2013	2	9:15	15:45	6.50	13.00
1240	Iceberg Lake	9/21/2013	2	9:00	15:45	6.75	13.50
1239	Iceberg Lake	9/21/2013	1	6:15	15:45	9.50	9.50
1109	Janet Lake	7/21/2013	2	9:20	12:20	3.00	6.00
1193	Janet Lake	8/24/2013	2	8:30	23:30	15.00	30.00
1079	Many Glacier Picnic	5/6/2013	1	13:10	14:10	1.00	1.00
1110	Numa Lookout	6/23/2013	2	7:45	17:10	9.42	18.83
1114	Numa Lookout	7/4/2013	8	8:00	20:30	12.50	100.00
1162	Numa Lookout	8/19/2013	1	5:00	18:00	13.00	13.00
1078	Ole Creek	6/13/2013	2	10:00	14:30	4.50	9.00
1247	Ole Creek	6/28/2013	2	12:00	19:00	7.00	14.00
1115	Ole Creek	7/11/2013	1	7:45	13:00	5.25	5.25
1116	Ole Creek	8/4/2013	1	12:30	22:00	9.50	9.50
1198	Ole Creek	8/24/2013	1	8:55	12:45	3.83	3.83
1213	Ole Creek	9/17/2013	1	10:25	14:25	4.00	4.00
1117	Otokomi Lake	7/16/2013	1	15:45	20:15	4.50	4.50
1160	Otokomi Lake	8/19/2013	2	10:15	21:30	11.25	22.50
1163	Otokomi Lake	8/20/2013	1	16:30	23:59	7.48	7.48
1199	Otokomi Lake	8/24/2013	2	7:30	16:30	9.00	18.00
1119	Park Creek	7/1/2013	7	8:00	16:30	8.50	59.50
1200	Park Creek	8/24/2013	1	8:40	16:15	7.58	7.58
1215	Park Creek	9/12/2013	1	8:30	18:30	10.00	10.00
1120	Pitamakin Pass	8/1/2013	3	7:00	17:00	10.00	30.00
1164	Pitamakin Pass	8/5/2013	1	8:45	19:00	10.25	10.25
1161	Pitamakin Pass	8/6/2013	1	8:30	18:30	10.00	10.00
1121	Poia Lake	6/11/2013	3	7:30	21:30	14.00	42.00

Mountain Goat/ Bighorn Sheep
Volunteer Hours

Goat_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
1250	Poia Lake	7/14/2013	1	8:00	18:00	10.00	10.00
1201	Poia Lake	8/24/2013	1	14:00	23:15	9.25	9.25
1214	Poia Lake	9/11/2013	2	8:00	23:59	15.98	31.97
1122	Preston Park	6/29/2013	1	5:45	15:45	10.00	10.00
1249	Preston Park	7/9/2013	1	7:00	22:00	15.00	15.00
1123	Preston Park	7/14/2013	1	8:30	16:30	8.00	8.00
1124	Preston Park	7/30/2013	3	7:00	17:15	10.25	30.75
1202	Preston Park	8/24/2013	1	6:00	14:00	8.00	8.00
1125	Red Eagle Lake	5/18/2013	1	7:30	19:45	12.25	12.25
1226	Red Eagle Lake	8/25/2013	2	8:00	16:00	8.00	16.00
1235	Red Eagle Lake	9/15/2013	1	8:00	18:30	10.50	10.50
1143	Scenic Point	6/17/2013	1	7:00	17:00	10.00	10.00
1127	Scenic Point	6/18/2013	1	8:30	16:30	8.00	8.00
1126	Scenic Point	7/22/2013	1	9:30	16:30	7.00	7.00
1165	Scenic Point	8/9/2013	2	9:00	15:00	6.00	12.00
1203	Scenic Point	8/24/2013	2	7:30	19:00	11.50	23.00
1224	Scenic Point	8/26/2013	5	13:25	21:05	7.67	38.33
1248	Siyeh Pass Loop	7/9/2013	1	7:00	22:00	15.00	15.00
1129	Siyeh Pass Loop	7/14/2013	1	6:45	16:45	10.00	10.00
1128	Siyeh Pass Loop	7/30/2013	3	7:00	17:15	10.25	30.75
1166	Siyeh Pass Loop	8/7/2013	7	7:45	18:45	11.00	77.00
1225	Siyeh Pass Loop	8/27/2013	4	9:40	20:45	11.08	44.33
1167	Siyeh Pass Loop	8/30/2013	1	8:30	20:30	12.00	12.00
1131	Sperry (alternative)	7/11/2013	1	9:00	11:30	2.50	2.50
1130	Sperry Chalet	7/23/2013	1	9:00	15:15	6.25	6.25
1204	Sperry Chalet	8/25/2013	2	15:42	16:32	0.83	1.67
1205	Sperry Chalet	8/25/2013	2	9:06	10:06	1.00	2.00
1222	Sperry Chalet	9/4/2013	1	11:45	12:45	1.00	1.00
1140	Stoney Indian Lake (unofficial)	8/5/2013	1	6:00	20:00	14.00	14.00
1168	Swiftcurrent Lookout	8/16/2013	1	7:30	18:30	11.00	11.00
1169	Swiftcurrent Lookout	8/20/2013	1	5:00	14:30	9.50	9.50
1206	Swiftcurrent Lookout	8/24/2013	1	9:50	14:35	4.75	4.75
1132	Triple Divide Pass	7/31/2013	3	7:00	18:20	11.33	34.00
1227	Triple Divide Pass	8/24/2013	2	7:00	18:05	11.08	22.17
1236	Triple Divide Pass	9/16/2013	1	8:30	19:00	10.50	10.50
1080	Trout Lake	6/12/2013	3	7:30	17:30	10.00	30.00
1133	Trout Lake	7/10/2013	1	16:00	23:59	7.98	7.98
1134	Trout Lake	7/12/2013	1	8:00	17:00	9.00	9.00
1135	Trout Lake	7/21/2013	1	6:00	17:30	11.50	11.50
1228	Trout Lake	8/24/2013	2	8:30	18:00	9.50	19.00
1216	Trout Lake	9/17/2013	4	7:00	16:15	9.25	37.00
1136	Upper Kintla	7/9/2013	1	8:30	18:30	10.00	10.00
1137	Upper Kintla	7/10/2013	1	7:00	17:00	10.00	10.00

Mountain Goat/ Bighorn Sheep
Volunteer Hours

Goat_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
1170	Upper Kintla	8/8/2013	1	10:40	17:00	6.33	6.33
1207	Upper Kintla	8/24/2013	1	7:50	18:30	10.67	10.67
1217	Upper Kintla	9/13/2013	2	15:30	20:45	5.25	10.50
1218	Upper Kintla	9/14/2013	2	9:30	15:45	6.25	12.50
1237	Upper Kintla	9/19/2013	1	11:30	16:00	4.50	4.50
1197	Upper Nyack	8/23/2013	1	10:00	18:00	8.00	8.00
1254	Upper Nyack	10/23/2013	1	13:00	17:20	4.33	4.33
							2857.24

High Country Citizen Science Project

Pika Monitoring

2013 Results:

- High country citizen scientists contributed over 4,386 hours of survey effort, (2,857 hours for mountain goat/ bighorn sheep surveys and a total of for 1,529 hours pika surveys (1,177 hours for surveys at I & M pika sites and 352 hours for surveys at additional pika sites).
- We conducted 14 training sessions (including outreach groups who conducted surveys) with 59 participants. Twelve returning citizen scientists went through training as a refresher throughout the summer.
- Citizen scientists completed 79 pika surveys
- 73 citizen scientists conducted pika surveys

Pikas

In 2012, Glacier National Park was the National Park Service's eighth National Park to join the Pika Inventory and Monitoring (I&M) Program. Through this program 47 survey sites were established and mapped by technicians (see "Pilot testing a pika monitoring protocol in Glacier National Park" for details on site selection and establishment). In 2013 our goal was to conduct pika surveys at 47 survey sites to determine whether a site is currently occupied, formerly occupied or unoccupied. Volunteers conduct pika surveys by locating a site marker, defining a 24 meter^2 area (representative of an individual pika territory), conducting a 5 minute observational survey, then traversing the talus for 15 to 30 minutes, documenting the presence of scat, haypiles, pikas or calls. Pika scat and photographs of haypiles are collected. Current occupancy of pikas is confirmed if citizen scientist sees a pika, collects fresh scat, or observes a fresh haypile during a survey. Each site is surveyed up to three times or until current occupancy is confirmed. A site is considered formerly occupied if only old scat or old haypiles are detected. After three surveys, a site that is not confirmed as currently occupied or formerly occupied is considered unoccupied. If current occupancy or former occupancy is not confirmed at a site that is surveyed less than three times, it is considered unconfirmed.

Glacier National Park is the first park that is conducting these surveys using only citizen scientists, rather than paid biological science technicians. More parks are likely to transition to using citizen scientists for their pika monitoring in future years due to lack of long-term funding. To assist with this effort, an additional goal was to make recommendations to the I & M program for ensuring data quality and for maximizing the reliability of data from citizen scientists. To that end we attempted re-survey at least 12 sites using biological science technicians (citizen science staff) to enable us to compare results from citizen scientists to results from biological science technicians, evaluate detection rates, and determine common sources of error or areas where additional training is needed. We also compiled feedback from citizen scientists to help us refine the protocols for our own use and for use in other parks that will need to use citizen science to continue their pika monitoring efforts in future years.

In 2013, citizen scientists conducted 64 surveys at 43 of the 47 I & M pika survey sites. The four sites that were not surveyed were not surveyed due to missing site markers (in 1 case) and unsafe locations in 3 cases. Current occupancy was confirmed at 31 out of 43 sites (72 %) by detection of with fresh sign or a pika. Formerly occupancy was confirmed at 6 sites . Six sites were classified as unconfirmed. Citizen scientists also conducted surveys at 5 sites that were formerly monitored using the GNP protocol from 2008-2011 and 5 sites that were discovered by observers.

Pika Citizen Science Monitoring in Glacier National Park: Final Report 2013

The summer of 2013 was the first field season that the Glacier National Park Citizen Science Program coordinated all surveys of pika monitoring sites using the new I&M protocol. Forty-seven pika sites were established within the park in 2012, and Glacier National Park resource staff plans to continue long-term monitoring of these sites through the use of trained volunteers. This pilot year provided an opportunity to evaluate the compatibility of the new pika survey locations and methods with the citizen science program. The results of 2013 can help park staff understand how to best adapt the pika monitoring protocol to the needs of citizen scientists, in order to effectively monitor Glacier's pika population.

In 2013 our goal was to conduct pika surveys at 47 survey sites to determine whether a site is currently occupied, formerly occupied or unoccupied. Volunteers conducted pika surveys by locating a site marker, defining a 24 meter^2 area (representative of an individual pika territory), conducting a 5 minute observational survey, then traversing the talus for 15 to 30 minutes, documenting the presence of scat, haypiles, pikas or calls. Pika scat and photographs of haypiles were collected.



Park staff train citizen scientists how to survey for pika sign in Glacier National Park (NPS Photo).

Individuals interested in pika monitoring were trained by park resource staff through both classroom demonstrations and hands-on practice in the field. Upon completion of training, citizen scientists borrowed NPS pika survey equipment, maps, and GPS units to complete pika surveys independently. Park resource staff also conducted pika surveys, in order to estimate sighting success (detection probability) of volunteers in the field at the end of the season. The overall goal of the summer was to survey each pika site until fresh pika sign was detected or until the site had been surveyed three times. This protocol was established to address concerns that volunteers with little experience might overlook pika sign.

Current occupancy of pikas was confirmed if citizen scientist saw a pika, collected fresh scat, or observed a fresh haypile during a survey. Each site was surveyed up to three times or until current occupancy was confirmed. A site was considered formerly occupied if only old scat or old haypiles were detected. After three surveys, a site that was not confirmed as currently occupied or formerly occupied is considered unoccupied. If current occupancy or former occupancy was not confirmed at a site that is surveyed less than three times, it is considered unconfirmed.

In 2013, 79 total pika surveys were completed at 43 of the 47 official pika survey sites. Of the 43 sites surveyed, 31 (72%) were recorded as "occupied," meaning that fresh sign or a pika was observed during the 2013 field season. In addition, 58 incidental pika observations were captured outside of survey plot areas. Seventy-three observers participated in pika surveys, including 4 resource staff and 69 volunteers. Due to time constraints, only 8 sites were independently surveyed by both park staff and volunteers. In only 2 of 8 cases (25%), the plot classification results (formerly occupied, currently occupied, or unoccupied site) found by citizen scientists matched the result found by park staff.

The 2013 monitoring effort was a significant step forward in continuation of long-term pika monitoring. The results illuminated a few potential issues that need to be addressed to increase the efficacy of pika monitoring by citizen scientists at Glacier National Park. Firstly, there is some concern regarding the limited number of sites that were surveyed by both types of observers (staff and non-staff). Most plot classification results completed by citizen scientists did not match the results found by park personnel at the 8 sites that were double-surveyed. Park staff was unable to resurvey more than eight sites due to time constraints caused by bad weather and the federal government shutdown. In future seasons it would be helpful to resurvey more sites, in order to determine if this discrepancy is due to citizen scientists being unable to detect, identify, or age pika sign. Another way to address this issue is through scat samples and photos of pika sign collected by volunteers during surveys. Staff confirmation of photos and scat age could potentially be used to confirm citizen scientist results without a staff resurvey in the field. Secondly, there were several issues encountered when observers attempted to access the new pika sites. Three sites were determined by park staff to be unsafe for volunteer access due to steep slopes/loose rock, distance from the trail, and an unsafe stream crossing. These sites should be reevaluated and likely relocated for volunteer ease of access in the future. Additional issues that were encountered included three missing site markers and inaccurate site UTMs at two sites. Thirdly, there were some problems with citizen scientists effectively implementing survey protocol and recording data. Volunteers frequently exceeded the 30 minute time limit for survey completion, due to difficulty in safely navigating talus fields, complexity of sites, and limited surveying experience. Also, observers frequently recorded pika observations outside of the 12 m radius survey plot within the survey data table. Incidental observations outside of the survey plot were also frequently not connected with UTM coordinates, often due to the difficulty of pinpointing coordinates of a pika call or sighting. Finally, volunteers did not consistently use the percentage and count ranges that were listed for scat counts and vegetation cover estimation, which provided a challenge for accurate data entry. These data entry issues can likely be addressed through training that specifically addresses these problems and/or modification of the survey form.

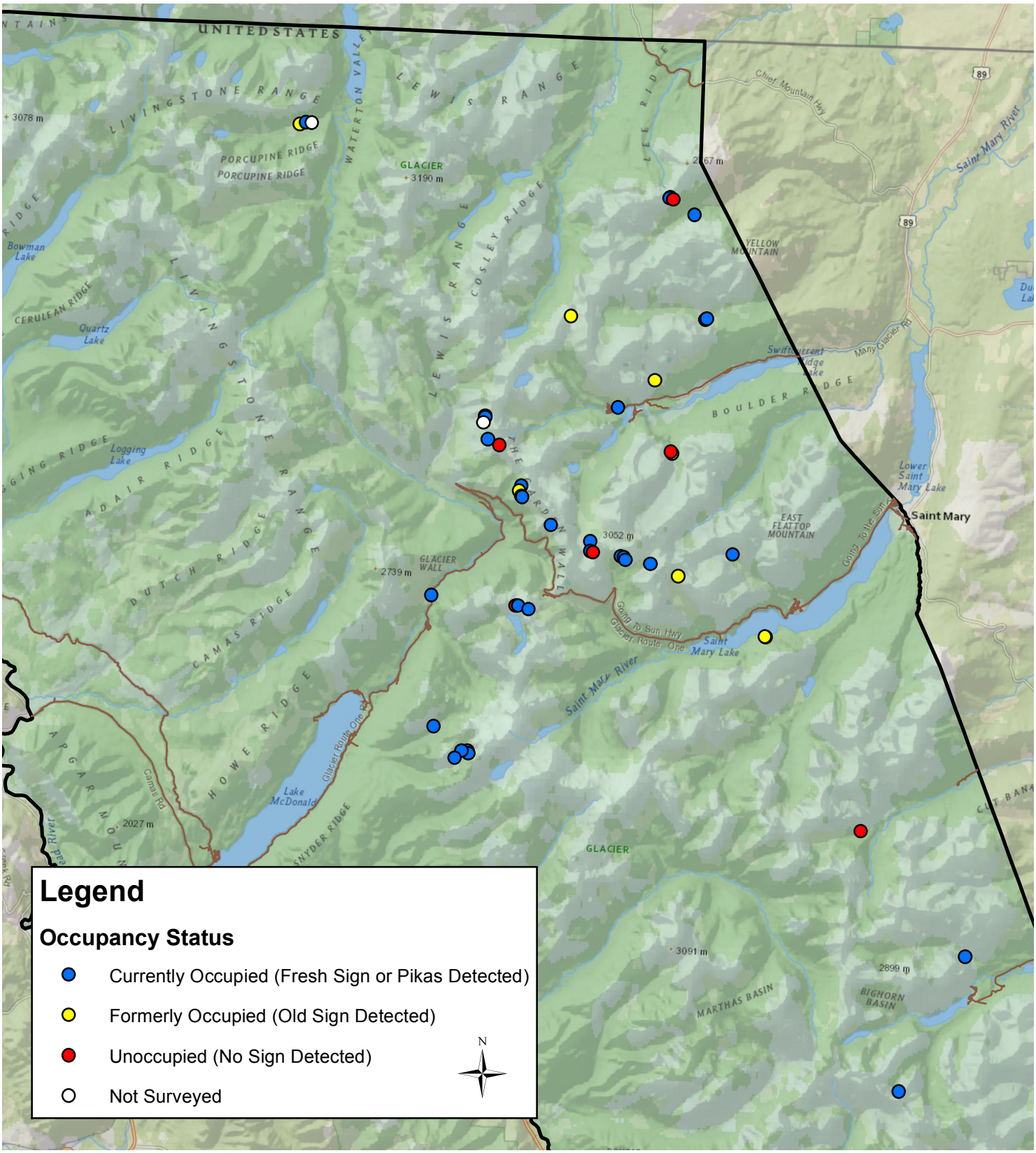
A few modifications of the I&M database for Glacier National Park would also be very useful for data entry. It would be helpful to link the pika database with the existing citizen science program observer database in order to more easily enter and maintain the long list of participants within the citizen science program. Additional minor data form changes would also be useful, including an area to record volunteer hours within the data entry form. We also compiled feedback from citizen scientists to help us refine the protocols for our own use and for use in other parks that will need to use citizen science to continue their pika monitoring efforts in future years. Addition of a table to allow us to enter this data into the database would facilitate use of this information. These modifications would be very helpful in maximizing data management efficiency.

The Glacier National Park Citizen Science Program provides an excellent opportunity to continue long-term pika monitoring and educate the public regarding pikas and climate change. Through addressing the minor issues encountered during the 2013 field season, citizen science can continue to provide an effective approach to monitoring pikas in Glacier National Park into the future.

Glacier National Park
Montana

National Park Service
U.S. Department of the Interior

Pika Survey Site Results 2013



Produced by Glacier National Park Citizen Science Program

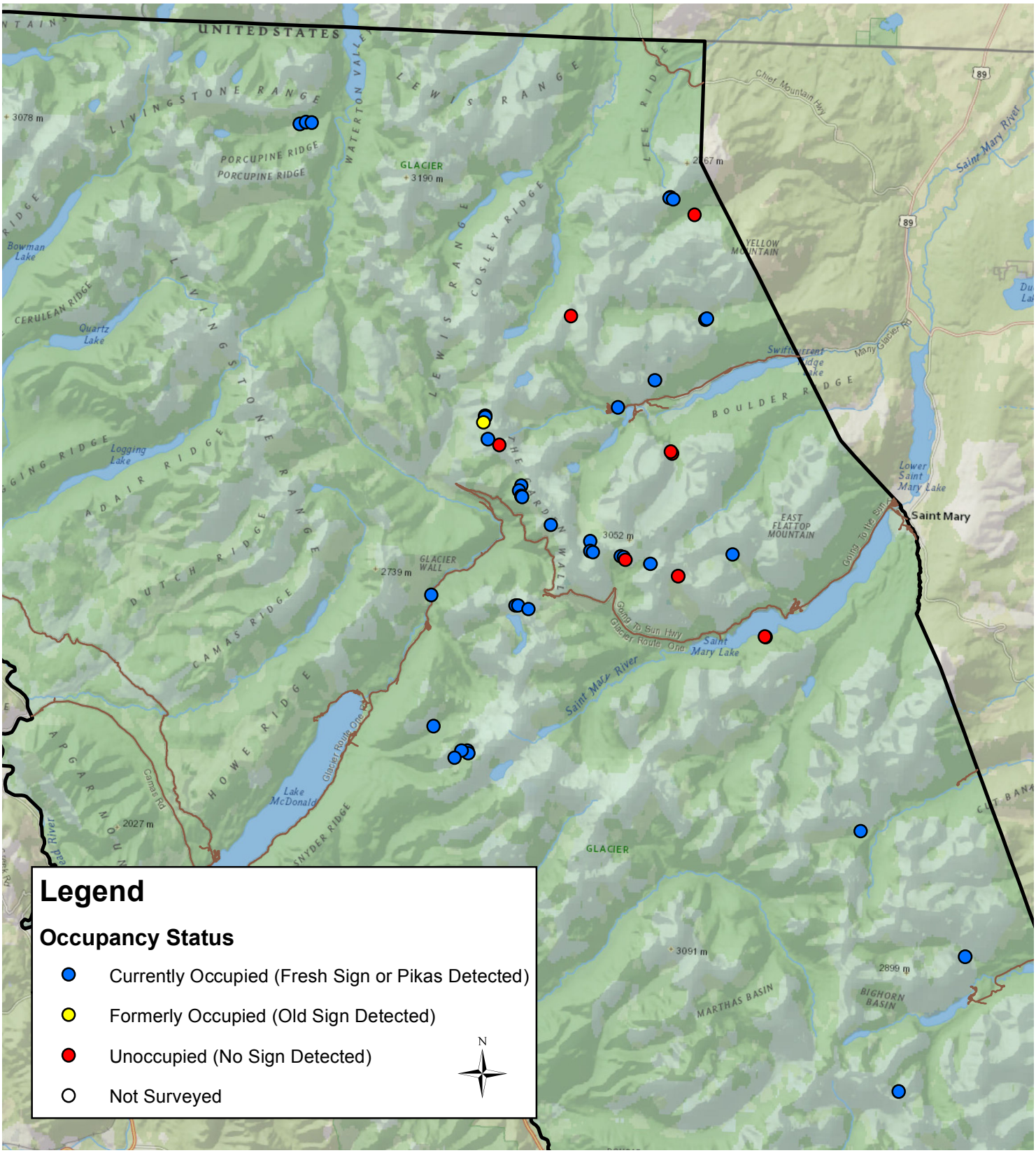
November 2013

FILE: Pika_Site_Maps_2013.mxd

Glacier National Park
Montana

National Park Service
U.S. Department of the Interior

Pika Survey Site Results 2012



0 1.5 3 6 9 12 Miles

Produced by Glacier National Park Citizen Science Program

November 2013

FILE: Pika_Site_Maps_2013.mxd

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Pilot Testing a Pika Monitoring Protocol in Glacier National Park

Project Report 2012 Natural Resource Technical Report
NPS/UCBN/NRTR—2013/667





ON THE COVER
Top left: An American pika at Glacier National Park
Photograph by: Kira Kranzler, 2012 University of Idaho field technician

Bottom right: Citizen scientists training for pika surveys in Glacier National Park
Photograph by: Jami Belt, Citizen Science Program Coordinator

Pilot Testing a Pika Monitoring Protocol in Glacier National Park

Project Report 2012

Natural Resource Technical Report NPS/UCBN/NRTR—2013/667

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January 2013

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Technical Report Series is used to disseminate results of scientific studies in the physical, biological, and social sciences for both the advancement of science and the achievement of the National Park Service mission. The series provides contributors with a forum for displaying comprehensive data that are often deleted from journals because of page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from (http://science.nature.nps.gov/im/units/ucbn/) and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/).

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NPS 117/119606, January 2013

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Abstract

The American pika (*Ochotona princeps*) is considered an indicator species for detecting ecological effects of climate change. Understanding pika population trends over time can provide important insights to park managers about potential impacts of climate change on park ecosystems. Pika monitoring is underway in several national park units across the western U.S. and this report describes the pilot effort to implement a standardized pika monitoring protocol in Glacier National Park, Montana. From July through September 2012, 47 pika monitoring sites were established and surveyed for pika site occupancy in the park. Sites were established along trails (up to 10 km from the trailhead) and within 100 m from trails, and occupancy of sites was determined by searching for pikas, pika calls, fresh haypiles, and fresh scat within 12-m radius plots. The proportion of sites surveyed that were considered occupied based on these detections was high at 0.81. Pikas were detected across the range of elevation of sites surveyed and throughout the areas surveyed in the park. Given the active citizen science program being coordinated by the park's Crown of the Continent Research Learning Center and the interest in having citizen scientists conduct the pika monitoring long term, citizen scientists were trained and conducted resurveys of the established sites. This provided an opportunity to compare the detection results between field technicians and citizen scientists and to identify ways to make pika monitoring feasible for implementation by citizen scientists in the future. A customized relational database application, implemented in Microsoft Access, was used to store and manipulate the data associated with this project and all project-related files have been provided to the park. Since this was funded as a 1-year pilot effort, the monitoring goals and responsibilities will be turned over to the park staff in 2013.

Acknowledgments

Funding for this project was provided by the National Park Service Climate Change Response Program. L. Garrett, G. Dicus, M. Biel, and P. Wilson provided valuable insights in the planning process of this pilot effort. M. Lonneker coordinated GIS analyses and data management, including creating and managing the Access database. M. Ratchford and K. Kranzler, University of Idaho field technicians, worked long, hard days to establish survey sites and coordinated many aspects of the field efforts, and two citizen science technicians, J. Porter and A. Strom, trained the citizen scientists and helped with many of the logistical tasks. We are also grateful for the 12 citizen scientists who volunteered their time conducting resurveys of the pika sites.

Introduction

The American pika (*Ochotona princeps*) is a small mammal related to rabbits and hares that inhabits rocky, often montane environments of western North America from British Columbia south to northern New Mexico (Hall 1981). Concerns regarding the pika's vulnerability to global climate change are growing, and many are considering the pika as a climate change indicator species (Smith 1974, McDonald and Brown 1992, Lawlor 1998, Beever et al. 2003, 2010, 2011, Krajick 2004, Smith et al. 2004, Grayson 2005). In some areas of the Great Basin localized extirpations of pika populations have been documented (Beever et al. 2003, Grayson 2005, Beever et al. 2010) and the species' range appears to have contracted as a response to climate change during the Holocene and last century (Hafner 1994, Hafner and Sullivan 1995, Beever et al. 2003, Grayson 2005, Moritz et al. 2008, Galbreath et al. 2009). The hypothesized mechanism for these range contractions is elevated temperatures and decreased mountain snowpack resulting from accelerated climate change (Smith et al. 2004, Grayson 2005). Although in 2010 listing of the American pika under the Endangered Species Act was deemed not warranted, the US Fish and Wildlife Service recognized that "climate change is a potential threat to the long-term survival of the American pika" and the agency called for further data on the status, trends, and determinants of pika distribution for future listing and management considerations (Crist 2010). The National Park Service's initiation of pika monitoring in several parks is an attempt to address these information gaps.

Pikas are popular and charismatic animals at Glacier National Park. A recent (2007-2009) survey of pikas and their habitat in the park conducted by Moyer-Horner (2011) identified 400 suitable habitat patches and documented a relatively large pika population (2071-4052 individuals) within the park. The park also has a very active citizen science program coordinated by the Crown of the Continent Research Learning Center with volunteers collecting scientific data on pikas, mountain goats, loons, aquatic macroinvertebrates, and others. This program led Moyer-Horner et al. (2012) to examine the ability of participants, including field technicians and citizen scientists, with wide ranges of experience and training to collect reliable data. Although Moyer-Horner et al. (2012) found that citizen scientists can collect reliable data via sitting surveys (focusing on visual and aural detections), they found that citizen scientists could not adequately estimate pika densities. However, this type of observer comparison has not occurred with the site occupancy survey methodologies described in the Jeffress et al. (2011) pika monitoring protocol that is being used widely in the National Park Service.

The purpose of this project was to pilot test a peer-reviewed, long-term pika monitoring protocol (Jeffress et al. 2011) for the American pika (*Ochotona princeps*) in Glacier National Park. The pika is a climate-sensitive species and this effort provided new information on the distribution, survey methodologies, and habitat associations of the species in the park. In particular, this project established long-term monitoring sites to estimate the proportion of sample sites occupied by pikas and assessed detectability of pika using both direct and indirect evidence of pika presence (via visuals, aurals, scat, and haypiles) for observers with various levels of experience and training. We worked with the Crown of the Continent Research Learning Center Citizen Science Program to evaluate the feasibility and effectiveness of citizen scientists in protocol implementation. Surveys were conducted summer 2012 and beginning in 2013, the park will take control of the monitoring of these sites, if funding is available.

Methods

Using a modified version of the Jeffress et al. (2011) protocol, we initiated this effort by identifying potential pika habitat and defining a sampling design for selecting monitoring sites. We then trained observers to conduct surveys in 12-m radius circular plots using standardized survey methods and data forms. Citizen scientists resurveyed the sites and field technicians entered the data into a customized Access database. These steps are detailed in the following sections.

Site Selection

Using a combination of existing GIS shapefiles provided by the park (file "Merge_All_Talus_Potential_Habitat.shp" stored in the GLAC project file directory in the DVD provided to the park and available upon request from the UCBN), including a potential pika talus habitat map created by L. Moyer-Horner and the park vegetation map, we identified ~32 trails (files: "10k_trailsselected_20120511.shp" and "talus_100m_Roads_class1trails.shp") and several road sites that had potential pika habitat of slopes < 35° and within 100 m of the trail or road. These areas were targeted for field sampling.

Each surveying effort began with the field technicians conducting an exploratory hike out 10 km or to the end of the trail, whichever came first. GPS coordinates for guidance as to where the trail starts, ends, and intersects other trails were provided. Also, coordinates for the center of mapped potential habitat patches that met our sampling criteria were provided to the technicians; however, it is important to note that patches on the maps often did not represent what was actually on the ground. Sometimes mapped habitat was not present on the ground and sometimes potential habitat was encountered but not identified using the GIS shapefiles. Therefore, technicians marked (with a GPS) the start and ending coordinates for each talus patch encountered (whether it was currently identified in the potential habitat map or not) along or near the trail (i.e., line-of-sight and within 100 m) and noted the approximate size of each patch (i.e., roughly < 1 football field = small patch; > 1 football field = large patch; Appendix A and Figure 1).

At the end of each trail, the technicians counted the number of talus patches encountered and based on the patch size, how many sites could be placed in each patch. If the patch was generally less than or equal to one football field in size (average area of 4,460 m^2), one site could be placed in that patch; if greater than one football field in size, two sites could be placed in that patch. The number of sites per trail was dependent on the length and habitat abundance and sites had to be a minimum of 50 m apart.

After the exploratory hike and as the technicians were hiking back toward the trailhead, they attempted to establish and survey as many of the sites identified for that trail as time allowed that day. However, some trails required multiple days to survey. Once the technicians encounter the first talus edge, they hiked 25 m father along the trail and stopped and evaluated the habitat. Distances were measured using a GPS unit and/or rangefinder. If the talus slope was accessible within 100 m in both left and right directions (perpendicular from the trail) they flipped a coin to determine which direction to go. Once direction was established the technician used a random distance chart to determine where to place the first site. The chart provided a list of randomized distances (12-100 m; 12 m minimum from the trail so the plot would not overlap with the trail).

At that point, the technicians began to establish a site for surveying and recorded the distance and direction used on the data form. If for some reason the technicians were not able to establish a site from 25 m along the trail (e.g., due to irregularly shaped talus, etc.), they walked another 5 m along the trail and evaluated if a site could be placed from there. The 5 m increments continued until a site could be established. The reverse was also possible for very small patches (i.e., 20 m or 15 m along the trail).

If a second site was to be established (= large patch), the technicians returned to the trail from the first site and hiked another 50 m along the trail (or halfway to the far end of the patch if it was a large patch, whichever was the farthest distance) to establish the second site. Once this distance was met, the technicians used the same criteria (i.e., new random distance, coin flip, etc.) as the first site. Please see Figure 1 for a hypothetical example of site establishment along a trail.

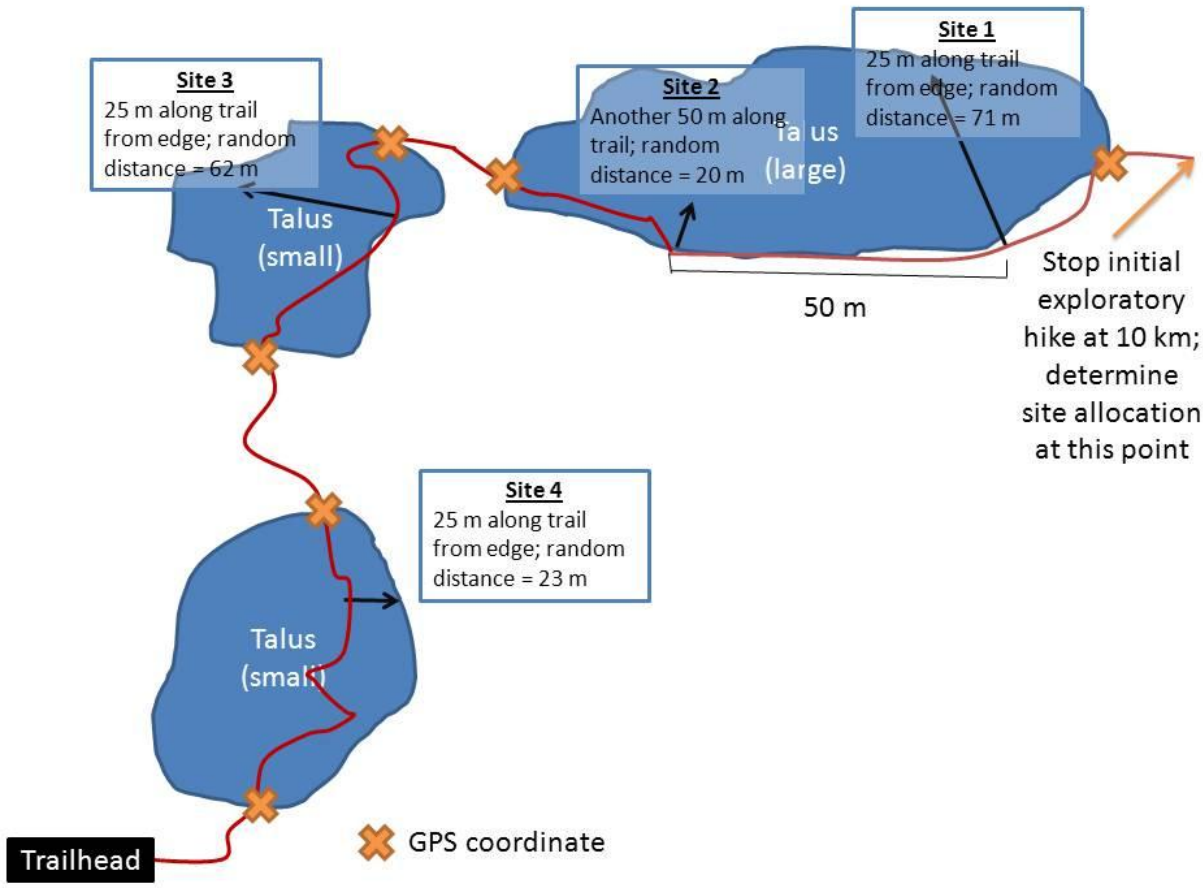


Figure 1. Example of site establishment. Please note that this diagram is not to scale.

All sites met the required potential habitat definition (see Table 1). Safety and ease of access was considered when establishing sites. As stated below, sites were not placed on slopes >35° or slopes that were perceived to be dangerous or unstable. The same considerations were made for the route to access the site; keeping in mind that citizen scientists/volunteers of varying skill/ability levels for hiking and/or cross-country navigation using a GPS unit would be resurveying the sites. A field manual describing these site selection and survey procedures was

provided to the field technicians for reference (PikaMonitoringManual_GLAC_Techs_20120713.docx).

Table 1. Criteria used for establishing a pika monitoring site in 2012.

Criteria for a site
The site must contain ≥10% target habitat. Target habitat includes talus, lava, outcrops or other forms of creviced rock that can provide shelter for pikas. Please note that scree or collections of small rocks (< 6 inches across) do not provide sufficient shelter for pikas.
The site must not be dangerous/prohibitively difficult to work on (e.g., slope >35°, rockfall imminent, or other unsafe conditions).
The site should be relatively snow-free (<10% snow cover). If the site has not yet experienced snowmelt (e.g., site is being surveyed early July), the site should be surveyed at a later date.
The site should be a minimum of 50 m for any other site as well as at least 12 m from the trail (so the search area does not overlap the trail), and no more than 100 m from the trail.

Occupancy Surveys

A site was defined as a 12-m radius plot containing ≥10% target habitat (see definition of target habitat in Table 1). Once the technician(s) reached the location for a site center (see "Site Selection"), the center was marked with an aluminum tree tag and rock cairn. The 12-m radius search area was temporary marked using a pre-measured cord and orange pin flags. One surveyor then thoroughly searched the entire plot and recorded all evidence of pika activity that he/she detected, including pika sightings, calls, scat, and hay. Information about the detection(s), including time, distance to center, number of scat pellets (if applicable), was also recorded. Once the surveyor felt the survey was complete (with a minimum search time of 15 minutes and suggested maximum of 30 minutes), the end time was noted. The technician(s) then conducted a vegetation survey, estimating the percentage of the plot that was rock, bare, graminoid (i.e., grasses), forbs (i.e., flowering, non-woody plants), shrubs, and trees (Appendix B). Finally, the technician(s) recorded directions and took photos of the site and the route to access the site in order to develop site location maps for the citizen scientists.

Citizen Science Resurveys

The Citizen Science Program of the Crown of the Continent Research Learning Center coordinated the citizen scientists' resurveys of sites. The technicians provided site guides to the Citizen Science Program coordinator who was responsible for training technicians and assigned scientists to survey sites. The technicians also produced a training video (available on YouTube: http://youtu.be/cP8iUfM2XpE) and an example completed data form to further help the citizen scientists understand the survey procedures. The citizen scientists were provided with field kits, which included pre-loaded GPS units, surveying equipment, etc. Citizen scientist data forms were a modified version of the original data forms and included a brief questionnaire about the surveying experience (Appendix C). Once surveys were completed, the citizen scientists provided the hard copy data forms back to the Citizen Science Program coordinator who then provided copies to the technicians for data entry.

Results

Site Selection

From July to September 2012, 20 trail segments (up to 10 km along the trail) and three potential roads sites were explored for potential pika habitat and pika sites by the field technicians. A description of trails surveyed and talus patches encountered is provided in GLAC_TrailAndTalusInfo_20120920.xls. With only several exceptions, including one avalanche forest knockdown along the Lake Josephine/North Piegan Pass Trail where a field of downed trees was identified as potential habitat, most of the potential habitat identified was rock, the majority of which was talus. However, only two of the potential roadside sites identified were suitable for survey sites, of which a site just east of Avalanche Creek was established. A roadside site in Many Glacier would be suitable talus; however, the area was inaccessible due to protection for habitat restoration. After establishing sites, the technicians developed and frequently updated a spreadsheet titled "High Country Citizen Science Pika Sites" (Pika_Site_List_sitesmapped_20120917.xlsx) to help citizen scientists identify the sites they wished to survey.

Occupancy Surveys

The technicians established and surveyed 47 sites (GLAC_2012_Occupancy.shp). Elevation of sites ranged from 1049 – 2301 m (3441 – 7549 ft) with a mean elevation of 1906 m (6255 ft). Based on the surveys conducted by the hired field technicians, 38 sites were considered occupied, one site had only old sign, and nine sites lacked any evidence of pika activity within the plot. Therefore, 81% of sites surveyed were considered occupied based on the field technician surveys (Figure 4). Mean elevation of occupied sites was 1913 m and mean elevation of unoccupied sites was 1878 m. Since previous studies in other areas have found that occupied sites tend to have more forbs and less grasses than unoccupied sites (Rodhouse et al. 2010; Jeffress et al. *in press*), we chose to examine this for our 2012 sites in Glacier. No clear trend presented itself in this analysis (Figures 2 and 3).

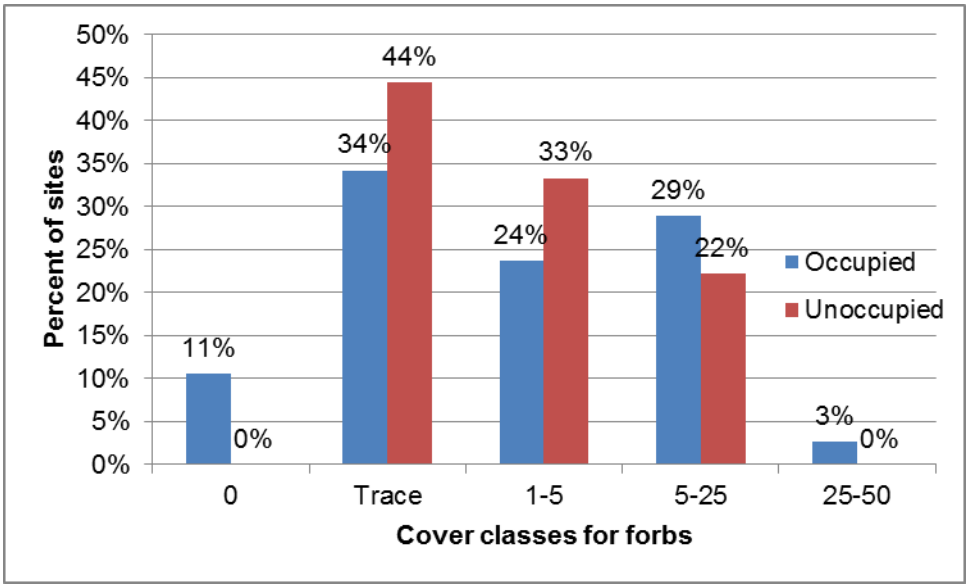


Figure 2. A comparison of forb cover estimates for occupied and unoccupied sites.

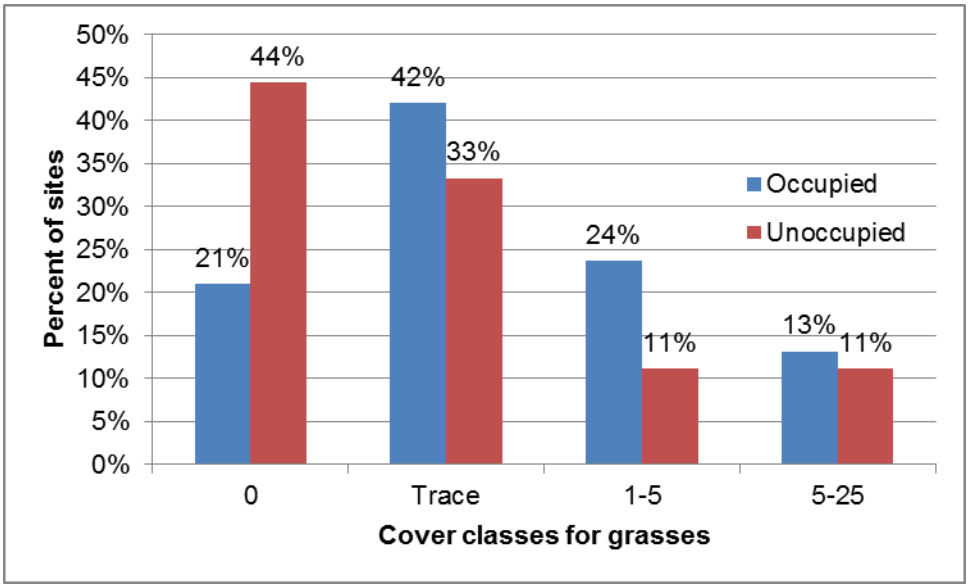


Figure 3. A comparison of graminoid (grasses) cover estimate for occupied and unoccupied sites.

Citizen science resurveys

A total of 25 resurveys of 19 sites established and initially surveyed by the field technicians were resurveyed by 12 citizen scientists. Two additional surveys were attempted but the citizen scientist did not feel comfortable accessing the sites. We note that the number of sites resurveyed by citizen scientists in 2012 was limited due to the fact that many sites were not established until later in the summer. For example, only 21 sites had been established and mapped by the time of the goat/pika blitz organized by the citizen science program, which occurred the third weekend of August. Now that sites have already been established and mapped, it is likely that citizen scientists will be able to conduct more resurveys in future years.

A comparison of the initial/technician survey results to the citizen scientist resurveys showed a significant difference in detectability. Only 32% (8) of the citizen scientist resurveys agreed with the initial survey results. In all cases where the citizen scientist resurvey results differed from the initial technician survey results, the technician survey found the site to be occupied and the citizen scientist resurveys found either only old sign or no pika evidence within the plot. Also, one of the concerns was the ability of citizen scientists to collect information on vegetation cover. We therefore compared the cover estimates of the technicians, with more experience at estimating vegetation cover, to the citizen science data and found that more than half of the estimates (52%) were consistent. Furthermore, when there were discrepancies between the estimates, there typically (35% of estimates) was only a difference of one cover class (e.g., “Trace” versus “1-5%”). Only 13% of the estimates by citizen scientists were greater than one cover classes different from the technician estimates.

Citizen scientist questionnaire on data form

We were able to use the questionnaire responses from 28 of the citizen science resurvey data forms. The scientists ranked the ability to traverse talus, the ability to navigate to/locate the site marker and the ability to age pika haypiles and scat as the most difficult tasks for pika surveys (Table 1); however, even these were ranked from easy to somewhat difficult. All other tasks

were ranked from very easy to easy. Average reported time to locate the marker was 8.3 minutes (11 responses). The most common reason for the citizen scientist to select that site was that it was a scenic area (13), followed by optimal hiking (8), and the site being in a new area (6). Other reasons less reported were optimal driving (2), safety considerations (2), and that the site was along a planned trip/trail (write-in; 10). The average reported number of sites completed by citizen scientists in a day was two. One citizen scientist reported that he did not feel comfortable accessing two sites (038 and 039). We also noted that the ranking of some of these variables, such as the ability to reach and traverse talus slopes, changes significantly depending on the site.

Table 2. Ratings for citizen science questionnaire regarding the ability to complete various survey tasks.

Please rate the following for this site on a scale of 1-5 (1 = very easy; 5 = very difficult)	**Number of respondents**	**Ranking**
Ability to reach the talus field	26	Very easy – easy (1.7)
Ability to traverse talus	27	Somewhat difficult (2.9)
Ability to navigate to/locate the site marker	25	Easy – somewhat difficult (2.5)
Ability to follow/understand the instructions and survey methods	25	Easy (1.8)
Ability to identify pikas	10	Very easy – easy (1.4)
Ability to identify pika sign	18	Very easy – easy (1.4)
Ability to age pika haypiles and scat	13	Easy – somewhat difficult (2.3)
Ability to complete search in allotted time	20	Easy (1.9)
Ability to estimate vegetation cover	20	Easy (2.1)

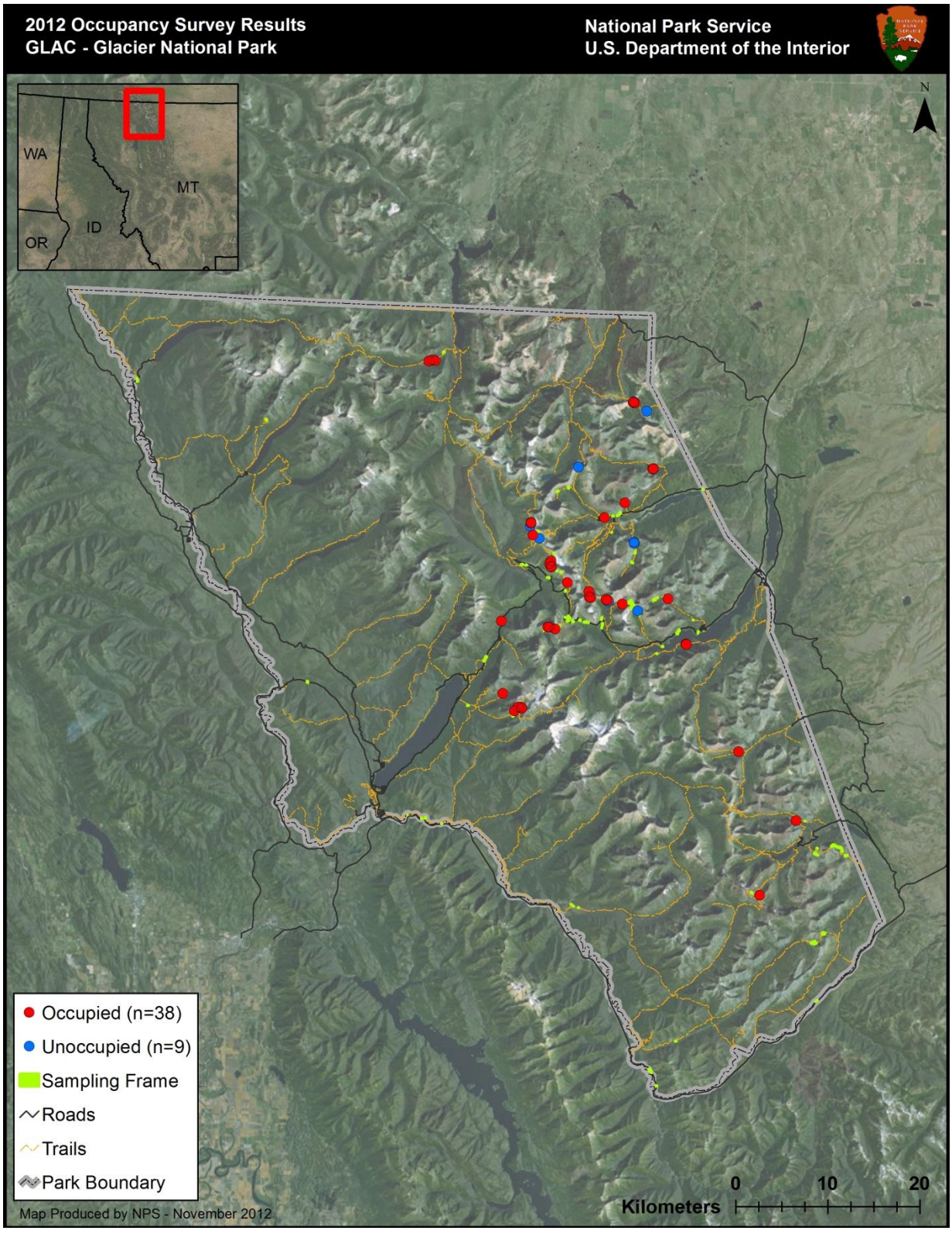


Figure 4. Map of sites established and survey results for 2012.

Discussion

The 2012 pika monitoring pilot effort was considered a success on many levels. All trails and road sites initially identified for surveys were explored and 47 sites established. Site occupancy was high (81%) suggesting that pikas currently occupied a vast majority of the potential habitat at the park. We saw no evidence of a lower elevational limit for pikas, although this could change in the future and a more thorough analysis of pika distribution along the elevational gradient should be conducted in GLAC. Furthermore, we saw no significant influence of forb or graminoid cover, which other studies, particularly those on the edge of the species' distribution and often in drier climates, have seen (e.g., Rodhouse et al. 2010). This is possibly because Glacier National Park is on the interior of the species' range and may be a "safer" core area for pikas. However, with predicted climate change these relationships may change in the future, reinforcing the need to monitor these sites and use any information regarding site losses as an early warning indicator.

Several issues presented themselves throughout this project and here we take an opportunity to provide suggestions for improving the monitoring design for future implementation in the park. First, in the planning efforts for not only Glacier National Park but other parks as well, accurately mapping potential habitat has proven challenging. We found that using the combination of maps previously developed for the park was the best indicator of areas to search but opportunities to improve these maps should be pursued, especially if any predictive mapping efforts are desired (see Rodhouse et al. 2010 for example). Furthermore, the field technicians and citizen scientists often noted that more potential habitat was available but did not fall within the strict 100 m buffer. Particularly, the technicians felt this cutoff impacted their ability to establish a large number of sites. They noted that they frequently encountered potential habitat within 100-500 m from the trail and many of the areas would have been fairly easy to access. If the park desires more sites for long-term monitoring, the buffer could be extended to capture more of this potential habitat. If this approach is chosen, we suggest using trained technicians or field personnel to properly identify these sites and use discretion regarding safety (erring on the side of caution).

In their end of the season reports (KKranzler_EndofSeasonReport_20120920.doc and MRatchford_EndofSeasonReport_20120926.docx), the field technicians also noted that the suggested 30 minute maximum search time was sometimes too short, particularly for structurally complex sites or sites with a large amount of sign. One technician noted that sometimes the search took up to 1 hour, even with someone else recording data. Similar concerns were expressed by the citizen scientists and this may help explain some of the false absences (described below). Since the point of monitoring is to maximize detectability for the best estimate of occupancy, we suggest extending the suggested maximum search time to 1 hour. This should be done while noting that the search period recommendations are to prevent surveyors from spending several hours until they find something or searching the same area over and over, thus biasing search effort. Another option to consider for long-term monitoring is to end the search once a fresh detection (i.e., visual, aural, fresh hay, or fresh scat) has been made within the plot. Although this has not yet been done in the other parks using the Jeffress et al. (2011) protocol, it would allow for a "time-saving" survey effort that still captures the primary occupancy information.

Another issue encountered was with the data forms completed by the citizen scientists. Technicians had a hard time entering citizen science data due to blank spaces or information not recorded properly on the data form, including site numbers. Consequently, opportunities to improve the citizen science data form presented themselves during data entry. The problems encountered and suggestions for improvement are as follows:

- **Site numbers were not always recorded**: Have the citizen scientists record site UTMs along with the site number. Then, if they don't record the site number, the UTMs could be used to determine which site they surveyed.

- **Missing or incomplete fields on data form:** These were most often for vegetation cover but also for sign type and others. Wherever there is an opportunity, provide a list of the options for that field (e.g., "0", "T", … for cover) and ask the citizen scientists to circle just one. This could also be done for detection type. Also, the fact that no field should be left blank could be emphasized during training (e.g., suggest writing "NA").

- **Time not recorded as military time:** Either make it clear that military time is desired (e.g., say "2400") or provide an AM / PM option to circle.

Improving the data forms and placing more emphasis on the concepts behind the survey methodologies, such as focusing on detections within the plot instead of outside of the plot, and data recording (i.e., complete data forms) during training may also help with some of these issues. However, we recognize that the citizen science program is constantly working on these types of training improvements and incomplete data forms are likely a struggle for many citizen science survey efforts.

Moyer-Horner et al. (2012) found that citizen scientists collected comparable data to that of technicians for visual and aural pika surveys but that technicians were better at detecting sign than volunteers. Our results are similar, where citizen scientists are missing a substantial amount of pika evidence found previously by the technicians, particularly fresh hay and fresh scat. These types of differences are referred to as "false absences" and can partially be accounted for with multiple resurveys to estimate detection probability. It is likely that the false absences / low detectability during resurveys by citizen scientists is due to their lack of confidence in identifying pika sign and/or their inexperience with these types of surveys. Anecdotally, it also appears the citizen scientists focused more on detections, particularly pika vocalizations and visuals, outside of the plot, especially at sites where the search area was in less than "ideal" pika habitat and "ideal" pika habitat was nearby. Some citizen scientists even noted that the plot should be moved to a nearby area where they saw or heard pikas. Since recording detections outside of the plot was an option to help note activity in the area and not essential to the monitoring, this option could be removed to focus citizen scientists on detections within the survey plot. Also, many of these issues, such as improving citizen scientist confidence in identifying and aging sign, could be emphasized during future trainings. We've found with other crews that "in the field" training is the best to help surveyors develop the "search image" for pikas and pika sign. Similarly, some citizen scientists noted that they were only able to complete one or two surveys and they needed more practice to be more comfortable with the new methodologies. Furthermore, the training site, which was chosen for accessibility, did not have fresh pika sign for the citizen scientists to observe so in the future we recommend, when possible, collecting fresh scat to use during

training and/or looking for better training sites with more pika activity. Although we ultimately recognize that citizen scientists appear to be more comfortable identifying pikas by sight and call, we do not recommend removing the sign search from the survey procedures as this would likely increase the occurrence of false absences and lead to an underestimation of occupancy.

Although, we cannot completely rule out that a seasonal effect could also be affecting the resurveys, other studies and pika surveying efforts have found high detectability when using technicians with a wildlife education background and typically detectability has improved as the season progresses (not declined as we saw here). A positive aspect of these results is that they do not suggest the occurrence of false positives (i.e., misidentify sign or saying an animal is present when it is not), which would be harder to account for, for the citizen scientist resurveys. Given these results, we encourage the continued documentation of detections with vouchers (i.e., photos or samples collected) when possible. Furthermore, if citizen scientists are used to implement monitoring in the future, multiple resurveys at each site should be conducted to provide multiple opportunities to detect if a site is occupied.

The results from the citizen science questionnaire could also be used to strengthen planning and training efforts in the future. For example, given the difficulty for some citizen scientists to access the sites, additional training on GPS use and identifying site markers may prove helpful. Similarly, one citizen scientist noted that two sites were too difficult to access. In this case, a difficulty ranking/measure for each site might help citizen scientists determine which sites are appropriate for them based on their capabilities and comfort levels. For example, some citizen scientists are backpacking for the surveys and they could use this information to determine that the site is too steep or difficult to access with heavy overnight packs. However, in summary the citizen scientists collected useful data, including cover estimates that were comparable to the technicians' estimates. Furthermore, the citizen scientists appeared to enjoy the pika surveys and we suggest this type of effort continue to be utilized.

All data files produced as a result of this effort are being provided to the park on a DVD and will also be kept on file with the UCBN. There is no long-term funding for this project; however, the hope is that in 2013 the park resources staff and Crown of the Continent Research Learning Center Citizen Science Program can use the results of this effort to resurvey/monitor the established sites. If additional sites are desired, we suggest allowing sites to reach further into the backcountry along trails and/or increasing the allowable distance from trails for sites.

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Appendix A. Data Form 1 – Trails and Talus Information (Glacier 2012)

Trails and talus information (Glacier 2012)

Date:

Observers:

Trail name:

Patch	Start UTMX	Start UTMY	Distance from trail*	End UTMX	End UTMY	Distance from trail*	Patch size	Patch sketched on map?	Site ID #s *(NA if no sites established in patch)*	Comments
Patch 1							Large / small	Yes / No		
Patch 2							Large / small	Yes / No		
Patch 3							Large / small	Yes / No		
Patch 4							Large / small	Yes / No		
Patch 5							Large / small	Yes / No		
Patch 6							Large / small	Yes / No		
Patch 7							Large / small	Yes / No		
Patch 8							Large / small	Yes / No		
Patch 9							Large / small	Yes / No		
Patch 10							Large / small	Yes / No		

*Only record if the start/stop of the patch edge does not intersect the trail.

Appendix B. Data Form 2 – Initial Pika Site Occupancy Survey (Glacier 2012)

Initial pika site occupancy survey (Glacier 2012)

Park: GLAC	Site ID:	Observer/s: Circle name of observer who conducted search			Date:
Trail name:		Distance of site from trail:		Azimuth of site from trail:	
Spot to leave trail	GPS acc. (m):	UTM Zone:	Easting:	Northing:	Points Averaged? YES NO
Site center	GPS acc. (m):	UTM Zone:	Easting:	Northing:	Points Averaged? YES NO
Arrival time:	Begin time for scat/hay search:		End time for scat/hay search:		Departure time:

Pika sign (types = **P**ika **S**ighting, **P**ika **C**all, **F**resh **H**aypile, **O**ld **H**aypile, **F**resh **S**cat, **O**ld **S**cat)

	Time (24-hr)	Sign type (PS, PC, FH, OH, FS, OS)	Distance (m) from site center	If FS, approx. # of pellets	If OS, approx. # of pellets	Notes
				Categories: <5, 5-9, 10-50, 51-100, >100		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Initial pika site occupancy survey (Glacier 2012)

Vegetation cover (% class*) in site	Rock:	Bare:	Grass:	Forb:	Shrub:	Tree:

*Percent classes: 0, T (<1%), 1-5, 5-25, 25-50, 50-76, 75-95, 95-100, 100

Site Notes (include description of area to turn on GPS unit, any hazards encountered, and distance of site from talus edge [if applicable]):

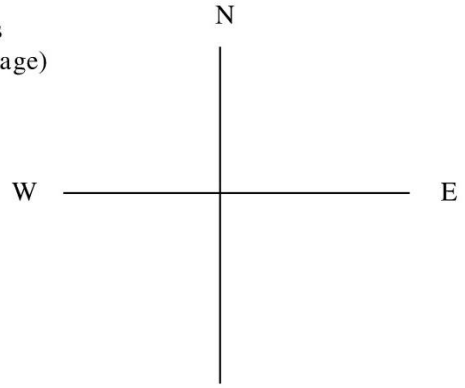
Plot Observation Notes (specific to that day's survey and could include other wildlife observations, etc.):

Photos: (coordinates only necessary if taken outside the site. Also, if need space for additional photos, use the notes section or the edge of the data form.)

1. Camera: _____ Initial name: _____ .jpg
   Dist. to center (m): _____ Azimuth to center (°): _____
   Description: _____ Final name: _____ .jpg
2. Camera: _____ Initial name: _____ .jpg
   Dist. to center (m): _____ Azimuth to center (°): _____
   Description: _____ Final name: _____ .jpg
3. Camera: _____ Initial name: _____ .jpg
   Dist. to center (m): _____ Azimuth to center (°): _____
   Description: _____ Final name: _____ .jpg
4. Camera: _____ Initial name: _____ .jpg
   Dist. to center (m): _____ Azimuth to center (°): _____
   Description: _____ Final name: _____ .jpg
5. Camera: _____ Initial name: _____ .jpg
   Dist. to center (m): _____ Azimuth to center (°): _____
   Description: _____ Final name: _____ .jpg

Site diagram:

Sketch sign locations (w/# from opposite page) and other useful information (e.g., landmarks, marker location, etc.)



Appendix C. Data Form 3 –High Country Citizen Science Pika Survey Form (Glacier 2012)

GLACIER NATIONAL PARK HIGH COUNTRY CITIZEN SCIENCE PIKA SURVEY FORM (2012)

Date:	**Observer (s):** (circle person who conducted search)		**Phone/Email:**
Citizen Science Hours (includes driving, hiking & survey time)		**Time at start of day:**	**Time at end of day:**
Trail Name:		**Number of miles hiked:**	**Site Name (#):** (on marker and/or map)
Arrival time at site:	**Begin time for traverse search:**	**End time for traverse search:**	**Departure time from site:**

TIME AND TYPE OF PIKA DETECTION (*Please write "none" if no pikas or sign observed during survey.***)**
PIKA DETECTION TYPES = Pika Sighting, Pika Call, Fresh Haypile, Old Haypile, Fresh Scat, Old Scat
*For the number of pellets, approximate into the following categories: <5, 5-10, 11-50, 51-100, >100

	Time of detection	Detection type (may list multiples per location)	Distance (m) from site center	If fresh scat, # of pellets*	If old scat, # of pellets*	Verification photo (Y/N)	Comments (Other wildlife and/or sign, uncertain detections, etc.)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Estimate % cover for each ground cover type (0, <1, 1-5, 5-25, 25-50, 50-75, 75-95, 95-100, or 100%):	Rock:	Bare ground (dirt, mineral soil, plant debris/ sticks):	Grass:	Forb (non-woody plants):	Shrub:	Tree:

CONTINUE ON REVERSE

GLACIER NATIONAL PARK HIGH COUNTRY CITIZEN SCIENCE PIKA SURVEY FORM (2012)

Please rate the following for this site on a scale of 1-5 (1 very easy; 5 very difficult):						
Ability to reach the talus field	1	2	3	4	5	NA
Ability to traverse talus	1	2	3	4	5	NA
Ability to navigate to/locate the site marker	1	2	3	4	5	NA
Ability to follow/understand the instructions and survey methods	1	2	3	4	5	NA
Ability to identify pikas	1	2	3	4	5	NA
Ability to identify pika sign	1	2	3	4	5	NA
Ability to age pika haypiles and scat	1	2	3	4	5	NA
Ability to complete search in allotted time	1	2	3	4	5	NA
Ability to estimate vegetation cover	1	2	3	4	5	NA

Approx. time to locate marker from trail (minutes):

Why did you select this site (check all that apply):
___ Scenic location ___ Safety consideration
___ New area of park
___ Optimal hiking distance/strenuousness
___ Optimal driving time/convenience
Other: _____

If last survey of the day, how many sites did you survey today: ____ sites

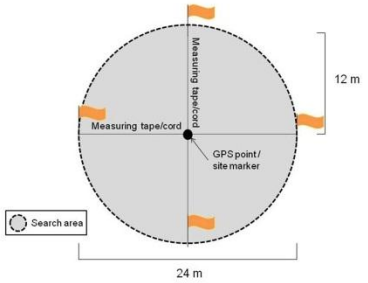
Notes, comments, or general feedback:

PIKA SURVEY PROCEDURES

Survey equipment: Measuring tape/cord, pin flags, and GPS unit.
Recommended: Leather gloves, camera, flashlight, and watch.

Surveys should not be conducted in inclement weather such as rain, snow, high winds

1. Navigate to survey site using route map, GPS point location and photo of reference on trail. Once close (~10 m) begin looking for the metal site marker and/or rock cairn. Once you find the site marker*, enter the site number as "Site Name" on the data form.*If you cannot find the site marker after some time (>30 minutes), move on to another site and notify the citizen science coordinator.
2. Use the measuring tape or cord to measure out 12-m to four edges of the plot, leaving a pin flag at each edge (see right). This will help you establish/visualize the search area. Note: Sometimes the plot will extend beyond the talus but you should still use same site center and plot edges. In these cases, all rock in the plot should be searched and all ground cover types in the plot, even if beyond the talus, incorporated in the cover estimates.
3. Sit quietly for 5 minutes, looking and listening for pikas. Record any detection of pikas within the plot as well as the approximate distance of the detection from the marker. Document all pikas seen or heard outside of the plot on a Wildlife Observation Form (R-10). Note type of observation in comments.



4. Begin searching the entire circular plot for the pika sign types (noting the start time on the form). You many record multiple detections in one row if those were found at the same location (e.g., fresh haypile and fresh scat in the same rock crevice). Search the site for a minimum of 15 minutes and a maximum of 30 minutes, ensuring to look in every possible crack and crevice through the search area. Record the time you completed the search.
5. Estimate the percent cover for each ground cover type and complete survey questionnaire (above).
6. Return survey forms ASAP by fax (406) 888-7903, or email glac_citizen_science@nps.gov, or mail GNP-CCRLC, PO Box 128, West Glacier, MT 59936

OTHER PIKAS SEEN DURING HIKE (OUTSIDE OF SURVEY PERIODS OR SURVEY PLOT):

Time at detection	Detection type (may list multiple types per location)	UTM's (NAD 83) Easting	UTM's (NAD 83) Northing	Specific location (mountain, aspect, trail mileage, etc.)	Comments

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NPS 117/119606, January 2013

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GLACIER NATIONAL PARK HIGH COUNTRY CITIZEN SCIENCE PIKA SURVEY FORM (2013)

***Date:**	**Observer (s):** (circle person who conducted search)	**Phone/Email:**
Citizen Science Hours (includes driving, hiking & survey time)	**Time at start of day:**	**Time at end of day:**
Trail Name:	**Number of miles hiked:**	**Site Name (#**on marker and/or map**):** If Site marker is not found, enter GPS coordinates of where you began your survey.
Arrival time at site:	**Begin time for traverse search:**	**End time for traverse search:**	**Departure time from site:**

TIME AND TYPE OF PIKA DETECTION (*Please write "none" if no pikas or sign observed during survey*.)

PIKA DETECTION TYPES = Pika Sighting, Pika Call, Fresh Haypile, Old Haypile, Fresh Scat, Old Scat

Fresh hay/scat contains visible chlorophyll (green tint) and some plasticity when squeezed. Old hay/scat is more brittle, contains little (hay) or no (scat) visible chlorophyll.

*For the number of pellets, approximate into the following categories: <5, 5-10, 11-50, 51-100, >100

	Time of detection	Detection type (may list multiples per location)	Distance (m) from site center	If fresh scat, # of pellets*	If old scat, # of pellets*	Verification photo (Y/N)	Comments (Other wildlife and/or sign, uncertain detections, etc.)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Estimate % cover for each ground cover type (0, <1, 1-5, 5-25, 25-50, 50-75, 75-95, 95-100, or 100%):	Rock:	Bare ground (dirt, mineral soil, plant debris/ sticks):	Grass:	Forb (non-woody plants):	Shrub:	Tree:

CONTINUE ON REVERSE

GLACIER NATIONAL PARK HIGH COUNTRY CITIZEN SCIENCE PIKA SURVEY FORM (2013)

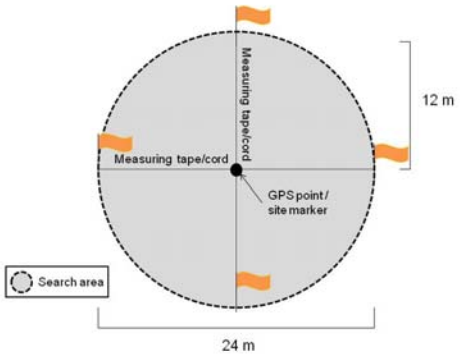
Please rate the following for this site on a scale of 1-5 (1 very easy; 5 very difficult):							Approx. time to locate marker from trail (minutes):
Ability to reach the talus field	1	2	3	4	5	NA	Why did you select this site (check all that apply):
Ability to traverse talus	1	2	3	4	5	NA	___ Scenic location
Ability to navigate to/locate the site marker	1	2	3	4	5	NA	___ New area of park
Ability to follow/understand the instructions and survey methods	1	2	3	4	5	NA	___ Optimal hiking distance/strenuousness
Ability to detect and identify pikas	1	2	3	4	5	NA	___ Optimal driving time/convenience
Ability to see under rocks completely	1	2	3	4	5	NA	___ Safety consideration
Ability to detect and recognize pika scat	1	2	3	4	5	NA	Other: _____
Ability to detect and recognize pika haypiles	1	2	3	4	5	NA	If last survey of the day, how many sites did you survey today: ____ sites
Ability to age pika haypiles and scat	1	2	3	4	5	NA	
Ability to complete search in allotted time	1	2	3	4	5	NA	
Ability to estimate vegetation cover	1	2	3	4	5	NA	
Notes, comments, or general feedback:							

PIKA SURVEY PROCEDURES

Survey equipment: Measuring tape/cord, pin flags, and GPS unit.
Recommended: Leather gloves, camera, flashlight, and watch.

Surveys should not be conducted in inclement weather such as rain, snow, high winds

1. Navigate to survey site using route map, GPS point location and photo of reference on trail. Once close (~10 m) begin looking for the metal site marker and/or rock cairn. Once you find the site marker*, enter the site number as "Site Name" on the data form.*If you cannot find the site marker after 15 minutes, conduct your survey from the closest location (within 10 feet according to your GPS unit), **record the GPS coordinates and notify us.**
2. Use the measuring tape or cord to measure out 12-m to four edges of the plot, leaving a pin flag at each edge (see right). This will help you establish/visualize the search area. Note: Sometimes the plot will extend beyond the talus but you should still use same site center and plot edges. In these cases, all rock in the plot should be searched and all ground cover types in the plot, even if beyond the talus, incorporated in the cover estimates.
3. Sit quietly for 5 minutes, looking and listening for pikas. Record any detection of pikas within the plot as well as the approximate distance of the detection from the marker. Document all pikas seen or heard outside of the plot on the table below. Note type of observation in comments.



4. Begin searching the entire circular plot for the pika sign types (noting the start time on the form). You many record multiple detections in one row if those were found at the same location (e.g., fresh haypile and fresh scat in the same rock crevice). Search the site for a minimum of 15 minutes and a maximum of 30 minutes, ensuring to look in every possible crack and crevice through the search area. Record the time you completed the search.
5. Estimate the percent cover for each ground cover type and complete survey questionnaire (above).
6. Return survey forms ASAP by fax (406) 888-7903, or email glac_citizen_science@nps.gov, or mail GNP-CCRLC, PO Box 128, West Glacier, MT 59936

OTHER PIKAS SEEN DURING HIKE (OUTSIDE OF SURVEY PERIODS OR SURVEY PLOT):

Time at detection	Detection type (may list multiple types per location)	UTM's (NAD 83) Easting	UTM's (NAD 83) Northing	Specific location (mountain, aspect, trail mileage, etc.)	Comments

Pikas in construction zones along the Going to the Sun Road Corridor

Memo from: Jami Belt

9/16/2013

Reports by contractors of pika activity in several construction zones along the GTSR corridor were brought to my attention. On 9/13/2013, I followed our NPS Inventory and Monitoring protocol to survey these locations and determined that pikas are indeed occupying these habitats. These areas are a concern as contruction of rock walls and road beds are currently planned. Disruption of the rock substrates that comprise these habitats, during excavation or debris piling, could alter the structure that allows for sufficient air spaces and eliminate these important habitats. These locations are significant as they represent a potential bridge along the linear GTSR feature between lower elevation and higher elevation habitats for pikas. These atypical habitats suggest a pika subpopulation that may be exhibiting resilience in habitat choice, and may be a contributor to the species' overall resilience to habitat change in the Park. The two areas of concern are detailed below.

1) Dead Horse Point

UTM coordinates (NAD 83, zone 12): 311750, 5395963

Extent of pika occupancy along the GTSR: 311736, 5395952; 311758, 5395986

The pikas are inhabiting the rocky area above the talus field on the south side of the road, an area that has already been filled with a small amount of construction debris, but not yet been significantly altered. Rock wall construction appears to be underway in this area. If construction crews could avoid excavating and piling material in this area it would allow the habitat to remain intact.





2) West of Gunsight Pass Parking Lot

UTM Coordinates (NAD 83, zone 12): 307582, 5394507

Extent of pika occupancy along the GTSR: 307637, 5394488; 307553, 5394513

The pikas are occupying a natural rock wall of red argillite, a very atypical habitat. The rock wall has been staked to delineate the footprint for construction planned in that area. If extra caution is used to avoid undercutting or excavating the rock wall, and to avoid piling any debris or material on the rock wall, the current habitat would not be altered. It may be necessary to revisit the staked out footprint areas and pull them back as far as possible from the rock wall to avoid unintentional disturbance.





Plot_ID	Field_Date	Start of Day	End of Day	Survey Hours	Last_Name	First_Name	Group Number	Organization	Begin_Time_Sign	End_Time_Sign
0041	9/13/2013	9:00	11:07	2.116666667	Bate	Lisa	1	NPS	10:25	11:05
0004	9/20/2013	11:25	15:20	3.916666667	Bate	Lisa	1	NPS	15:10	15:20
0005	9/20/2013	11:25	15:20	3.916666667	Bate	Lisa	1	NPS	14:20	14:36
0006	9/20/2013	11:25	15:20	3.916666667	Bate	Lisa	1	NPS	13:26	13:42
0013	9/20/2013	11:25	15:20	3.916666667	Bate	Lisa	1	NPS	11:25	11:49
0031	6/7/2013	12:00	19:30	7.5	Belt	Jami	1	NPS	16:35	16:51
0013	7/29/2013	10:00	18:40	8.666666667	Belt	Jami	1	NPS	14:21	14:41
0023	8/7/2013	7:45	18:45	11	Belt	Jami	1	NPS	12:40	13:08
0011	8/16/2013	7:30	18:30	11	Belt	Jami	1	NPS	11:48	12:18
0037	8/25/2013	8:00	11:00	3	Belt	Jami	1	NPS	11:20	11:50
0038	8/25/2013	11:00	15:30	4.5	Belt	Jami	1	NPS	10:45	11:00
0039	8/25/2013	15:30	16:00	0.5	Belt	Jami	1	NPS	16:45	16:52
0040	8/25/2013	16:00	20:30	4.5	Belt	Jami	1	NPS	17:45	18:00
0041	9/13/2013	9:00	11:07	2.116666667	Belt	Jami	1	NPS	10:25	11:05
0023	8/7/2013	7:45	18:45	11	Carolin	Tara	1	NPS	12:40	13:08
0045	8/3/2013	7:00	13:40	6.666666667	Daly	Nicholas	1	Volunteer	9:30	9:55
0041	9/13/2013	9:00	11:07	2.116666667	Donovan	Mary Ann	1	NPS	10:25	11:05
0046	8/3/2013	7:00	13:40	6.666666667	Dooley	Peter	1	Volunteer	9:30	9:55
0001	9/20/2013	8:00	15:00	14	Flathead High School IB	1st year 2013	2	Volunteer	11:45	12:15
0001	9/20/2013	8:00	15:00	14	Flathead High School IB	1st year 2013	2	Volunteer	11:15	11:45
0001	9/20/2013	8:00	15:00	14	Flathead High School IB	1st year 2013	2	Volunteer	11:45	12:15
0031	6/7/2013	12:00	19:30	7.5	Flesch	Elizabeth	1	NPS	16:35	16:51
0015	6/26/2013	7:20	17:30	10.16666667	Flesch	Elizabeth	1	NPS	16:49	17:13
0001	6/27/2013	7:30	17:30	10	Flesch	Elizabeth	1	NPS	16:14	16:49
0013	7/29/2013	10:00	18:40	8.666666667	Flesch	Elizabeth	1	NPS	14:21	14:41
0023	8/7/2013	7:45	18:45	11	Flesch	Elizabeth	1	NPS	12:40	13:08
0046	9/17/2013	7:00	15:00	8	Flesch	Elizabeth	1	NPS	11:15	11:44
0013	7/29/2013	10:00	18:40	8.666666667	Greyeyes	Shonto	1	Volunteer	14:21	14:41
0022	7/30/2013	7:00	17:15	10.25	Greyeyes	Shonto	1	Volunteer	10:20	10:45
0023	7/30/2013	7:00	17:15	10.25	Greyeyes	Shonto	1	Volunteer	15:00	15:30
0025	7/31/2013	7:00	18:20	11.33333333	Greyeyes	Shonto	1	Volunteer	15:45	16:05
0031	6/7/2013	12:00	19:30	7.5	Hanson	Taylor	1	NPS	16:35	16:51
0023	8/7/2013	7:45	18:45	11	Hanson	Taylor	1	NPS	12:40	13:08
0031	6/7/2013	12:00	19:30	7.5	Headley	Racheal	1	NPS	16:35	16:51
0029	8/6/2013	8:30	16:30	8	Headley	Racheal	1	NPS	12:50	13:20
0024	8/6/2013	8:00	19:30	11.5	Horner-Till	Susan	1	Volunteer	15:00	15:25
0019	8/19/2013	14:38	17:32	2.9	Horner-Till	Susan	1	Volunteer	16:30	16:41
0020	8/19/2013	14:38	17:32	2.9	Horner-Till	Susan	1	Volunteer	14:40	15:05
0021	8/19/2013	14:38	17:32	2.9	Horner-Till	Susan	1	Volunteer	17:17	17:29
0013	7/29/2013	10:00	18:40	8.666666667	June	Nathan	1	Volunteer	14:21	14:41
0017	7/30/2013	7:00	17:15	10.25	June	Nathan	1	Volunteer	13:16	13:40

Plot_ID	Field_Date	Start of Day	End of Day	Survey Hours	Last_Name	First_Name	Group Number	Organization	Begin_Time_Sign	End_Time_Sign
0020	7/30/2013	7:00	17:15	10.25	June	Nathan	1	Volunteer	11:25	11:40
0021	7/30/2013	7:00	17:15	10.25	June	Nathan	1	Volunteer	10:30	10:55
0002	7/31/2013	7:00	17:00	10	June	Nathan	1	Volunteer	11:20	11:45
0003	7/31/2013	7:00	17:00	10	June	Nathan	1	Volunteer	12:15	12:35
0024	8/24/2013	7:00	19:00	12	Laird	Darlene	1	Volunteer	13:45	14:00
0024	8/24/2013	7:00	19:00	12	Laird	Kassandra	1	Volunteer	13:45	14:00
0045	8/3/2013	7:00	13:40	6.666666667	Lemerande	Jordan	1	Volunteer	9:30	9:55
0030	7/16/2013	8:15	15:45	7.5	Lundgren	Nancy	1	Volunteer	14:50	15:40
0042	7/21/2013	12:20	14:15	1.916666667	Lundgren	Nancy	1	Volunteer	13:52	14:12
0043	7/21/2013	14:15	16:15	2	Lundgren	Nancy	1	Volunteer	15:38	16:09
0014	7/30/2013	16:55	18:00	1.083333333	Mauritzen	Clayton	1	Volunteer	17:14	17:44
0013	7/29/2013	10:00	18:40	8.666666667	Meher	Candice	1	Volunteer	14:21	14:41
0022	7/30/2013	7:00	17:15	10.25	Meher	Candice	1	Volunteer	10:20	10:45
0023	7/30/2013	7:00	17:15	10.25	Meher	Candice	1	Volunteer	15:00	15:30
0002	7/31/2013	7:00	17:00	10	Meher	Candice	1	Volunteer	11:20	11:45
0003	7/31/2013	7:00	17:00	10	Meher	Candice	1	Volunteer	12:15	12:35
0024	7/19/2013	8:30	19:00	10.5	Newsom	Becky	1	Volunteer	14:06	14:37
0026	9/11/2013	8:00	20:00	12	Newsom	Becky	1	Volunteer	19:29	19:41
0027	9/12/2013	8:00	20:00	12	Newsom	Becky	1	Volunteer	7:44	8:04
0010	9/26/2013	9:00	19:00	10	Newsom	Becky	1	Volunteer	15:20	15:39
0008	9/27/2013	10:30	18:30	8	Newsom	Becky	1	Volunteer	14:45	15:01
0023	8/7/2013	7:45	18:45	11	O'Connor	Rory	1	Volunteer	12:40	13:08
0023	8/7/2013	7:45	18:45	11	O'Connor	Evan	1	Volunteer	12:40	13:08
0022	8/27/2013	9:40	20:45	11.08333333	Oropeza	Freddy	1	Volunteer	13:55	14:10
0023	8/27/2013	9:40	20:45	11.08333333	Oropeza	Freddy	1	Volunteer	17:50	18:10
0034	7/2/2013	7:00	20:30	13.5	Oster	Stephanie	1	NPS	19:20	19:54
0032	7/3/2013	7:30	16:00	8.5	Oster	Stephanie	1	NPS	9:30	9:50
0033	7/3/2013	7:30	16:00	8.5	Oster	Stephanie	1	NPS	10:10	10:25
0035	7/3/2013	6:00	16:00	10	Oster	Stephanie	1	NPS	8:35	8:51
0031	6/7/2013	12:00	19:30	7.5	Ouellet	Nicky	1	Volunteer	16:35	16:51
0036	6/29/2013	12:00	19:00	7	Ouellet	Nicky	1	Volunteer	15:45	16:16
0024	7/19/2013	8:30	19:00	10.5	Ouellet	Nicky	1	Volunteer	14:06	14:37
0012	8/16/2013	8:00	18:00	10	Ouellet	Nicky	1	Volunteer	13:55	14:14
0013	8/16/2013	8:00	12:40	4.666666667	Ouellet	Nicky	1	Volunteer	12:10	12:30
0026	9/11/2013	8:00	20:00	12	Ouellet	Nicky	1	Volunteer	19:29	19:41
0027	9/12/2013	8:00	20:00	12	Ouellet	Nicky	1	Volunteer	7:44	8:04
0010	9/26/2013	9:00	19:00	10	Ouellet	Nicky	1	Volunteer	15:20	15:39
0008	9/27/2013	10:30	18:30	8	Ouellet	Nicky	1	Volunteer	14:45	15:01
0011	8/20/2013	5:00	14:30	9.5	Panagakis	Andrea	1	Volunteer	10:25	10:40
0042	7/21/2013	12:20	14:15	1.916666667	Peterson	Terry	1	NPS	13:52	14:12
0043	7/21/2013	14:15	16:15	2	Peterson	Terry	1	NPS	15:38	16:09

Plot_ID	Field_Date	Start of Day	End of Day	Survey Hours	Last_Name	First_Name	Group Number	Organization	Begin_Time_Sign	End_Time_Sign
0023	8/27/2013	9:40	20:45	11.08333333	Peyton	Stan	1	Volunteer	17:50	18:10
0023	8/27/2013	9:40	20:45	11.08333333	Rasmusson	Par	1	Volunteer	17:50	18:10
0038	9/4/2013	14:30	16:00	1.5	Rasmusson	Par	1	Volunteer	14:45	15:50
0024	8/24/2013	7:00	19:00	12	Reeves	Debra	1	Volunteer	13:45	14:00
0031	6/7/2013	12:00	19:30	7.5	Ressel	Dawn	1	Volunteer	16:35	16:51
0031	6/7/2013	12:00	19:30	7.5	Rinehart	Susan	1	Volunteer	16:35	16:51
0037	7/24/2013	9:00	13:00	4	Robbins	Dean	1	Volunteer	9:50	10:55
0013	7/29/2013	10:00	18:40	8.666666667	Roche	Alzada	1	Volunteer	14:21	14:41
0022	7/30/2013	7:00	17:15	10.25	Roche	Alzada	1	Volunteer	10:20	10:45
0023	7/30/2013	7:00	17:15	10.25	Roche	Alzada	1	Volunteer	15:00	15:30
0002	7/31/2013	7:00	17:00	10	Roche	Alzada	1	Volunteer	11:20	11:45
0003	7/31/2013	7:00	17:00	10	Roche	Alzada	1	Volunteer	12:15	12:35
0022	8/27/2013	9:40	20:45	11.08333333	Rose	Breanna	1	Volunteer	13:55	14:10
0023	8/27/2013	9:40	20:45	11.08333333	Rose	Breanna	1	Volunteer	17:50	18:10
0046	8/3/2013	7:00	13:40	6.666666667	Schlepp	John	1	Volunteer	9:30	9:55
0036	8/4/2013	9:00	17:00	8	Scully	Elliot	1	Volunteer	13:10	13:35
0036	8/4/2013	9:00	17:00	8	Scully	Kevin	1	Volunteer	13:10	13:35
0031	6/7/2013	12:00	19:30	7.5	Shannon	Chuck	1	Volunteer	16:35	16:51
0047	7/24/2013	8:45	16:10	7.416666667	Siegler	Jeannie	1	Volunteer	13:00	13:57
0031	8/25/2013	8:20	15:35	7.25	Siegler	Jeannie	1	Volunteer	10:55	11:48
0013	7/29/2013	10:00	18:40	8.666666667	Silvis	Matt	1	Volunteer	14:21	14:41
0017	7/30/2013	7:00	17:15	10.25	Silvis	Matt	1	Volunteer	13:16	13:40
0020	7/30/2013	7:00	17:15	10.25	Silvis	Matt	1	Volunteer	11:25	11:40
0021	7/30/2013	7:00	17:15	10.25	Silvis	Matt	1	Volunteer	10:30	10:55
0025	7/31/2013	7:00	18:20	11.33333333	Silvis	Matt	1	Volunteer	15:45	16:05
0023	8/7/2013	7:45	18:45	11	Sladek	Melissa	1	NPS	12:40	13:08
0001	7/23/2013	6:45	18:50	12.08333333	Steele	Theresa	1	Volunteer	12:00	13:35
0016	8/10/2013	6:00	18:30	12.5	Steele	Gail	1	Volunteer	11:05	11:20
0018	8/10/2013	6:00	18:30	12.5	Steele	Gail	1	Volunteer	12:50	13:07
0019	8/10/2013	6:00	18:30	12.5	Steele	Gail	1	Volunteer	14:05	14:30
0021	8/10/2013	6:00	18:30	12.5	Steele	Gail	1	Volunteer	15:20	15:50
0013	7/29/2013	10:00	18:40	8.666666667	Stewart	Evan	1	Volunteer	14:21	14:41
0017	7/30/2013	7:00	17:15	10.25	Stewart	Evan	1	Volunteer	13:16	13:40
0020	7/30/2013	7:00	17:15	10.25	Stewart	Evan	1	Volunteer	11:25	11:40
0021	7/30/2013	7:00	17:15	10.25	Stewart	Evan	1	Volunteer	10:30	10:55
0025	7/31/2013	7:00	18:20	11.33333333	Stewart	Evan	1	Volunteer	15:45	16:05
0016	8/10/2013	6:00	18:30	12.5	Summer	Barbara	1	Volunteer	11:05	11:20
0018	8/10/2013	6:00	18:30	12.5	Summer	Barbara	1	Volunteer	12:50	13:07
0019	8/10/2013	6:00	18:30	12.5	Summer	Barbara	1	Volunteer	14:05	14:30
0021	8/10/2013	6:00	18:30	12.5	Summer	Barbara	1	Volunteer	15:20	15:50
0024	8/6/2013	8:00	19:30	11.5	Till	Jim	1	Volunteer	15:00	15:25

Plot_ID	Field_Date	Start of Day	End of Day	Survey Hours	Last_Name	First_Name	Group Number	Organization	Begin_Time_Sign	End_Time_Sign
0024	8/6/2013	8:00	19:30	11.5	Till	Robyn	1	Volunteer	15:00	15:25
0019	8/19/2013	14:38	17:32	2.9	Till	Jim	1	Volunteer	16:30	16:41
0019	8/19/2013	14:38	17:32	2.9	Till	Robyn	1	Volunteer	16:30	16:41
0020	8/19/2013	14:38	17:32	2.9	Till	Jim	1	Volunteer	14:40	15:05
0020	8/19/2013	14:38	17:32	2.9	Till	Robyn	1	Volunteer	14:40	15:05
0021	8/19/2013	14:38	17:32	2.9	Till	Jim	1	Volunteer	17:17	17:29
0021	8/19/2013	14:38	17:32	2.9	Till	Robyn	1	Volunteer	17:17	17:29
0013	7/29/2013	10:00	18:40	8.666666667	Travis	Paul	1	Volunteer	14:21	14:41
0034	7/2/2013	7:00	20:30	13.5	Vanhorn	Alex	1	Volunteer	19:20	19:54
0032	7/3/2013	7:30	16:00	8.5	Vanhorn	Alex	1	Volunteer	9:30	9:50
0033	7/3/2013	7:30	16:00	8.5	Vanhorn	Alex	1	Volunteer	10:10	10:25
0035	7/3/2013	6:00	16:00	10	Vanhorn	Alex	1	Volunteer	8:35	8:51
0036	8/4/2013	9:00	17:00	8	Weber	Shana	1	Volunteer	13:10	13:35
0014	9/9/2013	8:00	19:30	11.5	Williams	Becky	1	Volunteer	14:50	15:20
				1177.533333						

Invasive Plants Citizen Science Project

2013 Results:

- 387 Hours Volunteered (not including Noxious Weed Blitz)
- Eleven Noxious Weed Blitz participants contributed an additional 66 hours of volunteer effort
- 38 trails and sites surveyed
- 44 surveys completed
- 44 citizen scientists completed at least one survey (18 citizen scientists completed 3 or more surveys) during the 2013 season
- We conducted 6 training sessions (including outreach groups who conducted surveys) with 69 participants (including 2 returning citizen scientists and 61 outreach participants and Noxious Weed Blitz attendees)

Invasive Plant Monitoring:

Citizen scientists search for 5 targeted invasive plants and 3 additional watch list species while hiking along trails. Locations of any invasive plants detected are recorded with GPS units, size of patch is estimated, and distribution and stage of growth is recorded. The primary goal is for citizen scientists to assist Glacier's Invasive Plant Management Team with early detection/rapid response by documenting invasive plants in locations that park staff cannot regularly survey. During the 2013 season, citizen scientists surveyed 229 miles of backcountry trails surveyed, hiking over 387 miles.

Citizen scientists are trained in one of two ways: 1) completing an on-line training session that is posted on Glacier's website, or 2) attending our Annual Noxious Weed Blitz. In 2013 we trained 11 participants during the Noxious Weed Blitz. During traditional classroom/ field training sessions we also trained 41 Montana Conservation Crew interns, and 2 previously trained citizen scientists. We announced the Invasive Plants Citizen Science Online Training in two press releases and in 2013, 6 participants completed training using the on-line training module before their visit to the park. We also started a partnership with Flathead Valley Community College's Adaptive Resource Management Course. The course instructor and 9 FVCC students conducted the on-line training and then came to the park to review, ask questions and practice identifying weeds in the field. They visited the park during two additional field trips to conduct weed surveys and assist with weed pulling. We solicited and compiled feedback on the on-line invasive plant training materials from all trainees.

In 2013 we also explored the use of an invasive plant app for smartphones developed for the National Park Service. We worked with the app developers to help with metadata development and attempted to receive permission to be one of the 5 parks to pilot test the app, but did not receive a response. We will pursue this again in 2014 as a means to expand our audience and increase the coverage invasive plant detection on backcountry trails.

2013 Invasive Plant results

Targeted invasive plants were found on 23 trails with a total of 1,369,561 square feet (31.4 acres) of estimated area. Eight species of invasive plants were recorded at 35 different sites. Of the 35 infestation sites, nine were previously undocumented infestations. Four had spotted knapweed, three had Canada thistle and two were infested with St. Johnswort.

The treatment for these infestations would vary by species and would include hand pulling the entire plant or cutting and bagging the flower heads. This work would be done by the Integrated Pest Management (IPM) crew, backcountry rangers, volunteers and other park employees. Priorities would depend on the species and the size of the infestation and the effectiveness of hand pulling or cutting off the flower heads.

2013 Citizen Science Invasive Plant Surveys

Site	Surveys completed	Targeted weeds found	hours	# people	Total hours	Miles	Total miles	Species found	Area (sq. feet)	Species found	Area (sq. feet)	Species found	Area (sq. feet)	Species found	Area (sq. feet)	Species found	Area (sq. feet)	Species found	Area (sq. feet)	Additional species
Apgar Bike Trail	1	yes	4	2	8	4	8	CENMAC	105,600			CHRLEU	105,600			HYPER	105,600	HIEAUR	2000	
Apgar Bike Trail	1	yes	1	3	3		4	CENMAC	105,600	LINVUL	105,600	CHRLEU	105,600							
Autumn Creek	1	yes	9	10	90	2.6	5.2	CENMAC	150	LINVUL	150	CHRLEU	150							
Avalanche Lake	1	no	5.75	3	17.25	3.3	6.6													
Baring Creek to Siyeh Pass	1	yes	10.75	2	21.5	4.4	8.8	CENMAC	1											
Baring Falls	1	no	4.75	3	14.25	0.6	1.2									HYPPER	11504			
Beaver Pond Trail	1	no	5.45	3	16.35	3	3													
Belly River Ranger Station	1	yes	6.25	2	12.5	9.1	9.1											HEIAUR	1	
Coal Creek	1	yes	12	1	12	15	15					CHRLEU	105,600			HYPPER	105,600			
Coal Creek	1	yes	5	1	5	7	7	CENMAC	25			CHRLEU	100							
Cracker Lake Trail	1	no	9.75	3	29.25	6	12													
Dry Fork Creek	1	yes	7	1	7	2.4	4.8									HYPPER	106			
Fifty Mountain	1	yes	7	3	21	12	24	CENMAC	60									HIEAUR	2	
Grinnell Lake	1	no	8	3	24	3.4	6.8													
Harrison Lake	1	yes	9	1	9	7	14									HYPPER	900			CIRARV
Hidden Lake (to overlook)	1	no	7.75	3	23.25	1.5	3													
Hidden Lake (to overlook)	1	no	8.5	1	8.5		3													
Hidden Lake (to lake)	1	no	6.75	1	6.75	3	6													
Huckleberry Nature Trail	1	no	4.75	3	14.25	0.6	1.2													
Iceberg Lake	1	no	6	3	18	4.8	9.6													
Lower Nyack	1	yes	5	1	5	6	6	CENMAC	400											
McDonald Creek (below Apgar bridge)	1	yes	5	1	5	0.3	0.6	CENMAC	1											
Mokowanis Lake	1	no	12	1	12	17	34													
Ole Creek	1	yes	8	2	16	3.5	7					CHRLEU	75			HYPPER	407,500	HIEAUR	80,000	
Ole Creek	1	yes	4	1	4		5.4													
Pitimakin Loop	1	no	10	1	10	18	18													
Ptarmigan Falls	1	no	4.5	3	13.5	3.3	6.6													
Quartz Lake Loop	1	yes	10	1	10	13	12											HIEAUR	125	
Red Eagle Lake	1	yes	10.5	1	10.5	7.6	15.2	CENMAC	9											CIRARV
Rocky Point	1	no	3	3	9	1.1	2.2													
Running Eagle Falls	1	no	5.15	3	15.45	0.75	1.5													
Running Eagle Falls	1	yes	9	2	18		1.5	CENMAC	1											
Scenic Point	1	no	6	2	12	3.6	7.2													
Scenic Point (to Mt Henry)	1	yes	9	2	18	2	4	CENMAC	8000											
Siyeh Pass Loop	1	no	10.25	3	30.75	10.6	10.6													
South Boundary Trail (to old bridge)	1	yes	1.5	11	16.5	0.75	1.5	CENMAC	2500			CHRLEU	2500			HYPPER	2500			
South Boundary Trail (to switchbacks)	1	yes	2.5	9	22.5	2	4	CENMAC	800	LINVUL	25	CHRLEU	800			HYPPER	25			
Sperry Chalet	1	yes	7.5	1	7.5	7.25	14.5					CHRLEU	1							
St. Mary Lake Trail	1	yes	11.2	3	33.6	5.6	11.2	CENMAC	2000							HYPPER	2000			
Swiftcurrent Pass	1	yes	11	3	33	7.6	13.2							CYNOFF	150					
Trail of Cedars	1	no	4.25	3	12.75	0.2	0.4													
Triple Divide	1	no	10.5	1	10.5	7.2	14.4													
Upper Nyack	1	no	12	1	12	22	22					CHRLEU	200							CIRARV, VERTHA
Upper Nyack	1	no	12.5	1	12.5		22													CIRARV
	44	23	322.8	112	710.9	229.1	387.3	CENMAC	225147	LINVUL	105775	CHRLEU	320626	CYNOFF	150	HYPPER	635735	HIEAUR	82128	
44 surveys								1369561												
38 trails/ areas surveyed																				
Targeted invasive plants found on 23 trails																				
Total square feet of weeds reported= 1,369,561																				
8 species reported																				

GLACIER NATIONAL PARK INVASIVE PLANT CITIZEN SCIENCE SURVEY FORM

Site Name:_____ Date: ____/____/____ Name of Observer(s): _____
Citizen Science Hours (includes driving, hiking & survey time): Time at start of day: _____ Time at end of day: _____
Trail hiked: _____Start Location:_____ End Location:_____ Number of Miles:_____
GPS make and model:_____ GPS Datum: NAD 83 (select if using Citizen Science GPS unit) _____ NAD 27_____ Other:_____

Invasive plants and codes:

Spotted Knapweed = **CENMAC** Oxeye Daisy = **CHRLEU** Houndstongue = **CYNOFF** *Yellow Starthistle = **CENSOL**
St. Johnswort = **HYPPER** Yellow Toadflax = **LINVUL** *****Orange Hawkweed = **HEIAUR** *Blueweed = **ECHVUL**
*Additional species to report if you are able identify them
**List other invasive plants you can identify with certainty by common or scientific name

Patch	Species	Length of patch (ft)	Width of patch (ft)	Distri-bution	# of plants	UTM easting from GPS unit	UTM northing from GPS unit	Error (ft)	Stage of growth	Photo taken (y/n)	Comments: (include landmarks to locate patch, observation of animal browse on invasive plants, etc.)

- **Patch-** denotes the first location you see an invasive plant species or group of species
- **Species**- use codes above to list all species in patch that you can correctly identify
- **Length and Width**- Estimate the length and width of the area covered by each species in the patch.
  If the patch is too large to measure, record a beginning and ending UTM coordinate for length, then estimate the width of the infestation.
- **Distribution- choose one**: scattered (across patch) ; clumped; continuous cover (covering all ground); isolated individual; isolated clump
- **# of plants- choose one**: 1plant; 2-10; 11-20; 21- 50; 51-200; over 200
- **UTM easting, UTM northing and Error**- record this from the satellite page of your GPS. This info is critical- please record whenever possible.
- **Stage of growth- choose one**: rosette (first year growth of leaves only); bud; flowering; seeding
- **Please send completed survey forms and photos to Glac_Citizen_Science@nps.gov; or GNP-CCRLC, P.O. Box 128, West Glacier, MT 59936, or fax to (406)888-7903**

Invasive plants and codes:

Spotted Knapweed = **CENMAC** Oxeye Daisy = **CHRLEU** Houndstongue = **CYNOFF** *Yellow Starthistle = **CENSOL**
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**List other invasive plants you can identify with certainty by common or scientific name

Patch	Species	Length of patch (ft)	Width of patch (ft)	Distri-bution	# of plants	UTM easting from GPS	UTM northing from GPS	Error (ft)	Stage of growth	Photo taken (y/n)	Comments: (include landmarks to locate patch, observation of animal browse on invasive plants, etc.)

- **Patch-** denotes the first location you see an invasive plant species or group of species
- **Species**- use codes above to list all species in patch that you can correctly identify
- **Length and Width**- Estimate the length and width of the area covered by each species in the patch.
  If the patch is too large to measure you can estimate the acreage of the unit or record a beginning and ending UTM coordinate
- **Distribution- choose one**: scattered; clumped; continuous cover; gradient (denser on one side); isolated individual; isolated patch
- **# of plants- choose one**: 1plant; 2-10; 11-20; 21- 50; 51-100; 101- 200; over 200
- **UTM easting, UTM northing and Error**- record these numbers from the satellite page of your GPS unit.
- **Stage of growth- choose one**: rosette (first year growth of leaves only); bud; flowering; seeding
- **Please send completed survey forms and photos to Glac_Citizen_Science@nps.gov; or GNP-CCRLC, P.O. Box 128, West Glacier, MT 59936, or fax to (406)888-7903**

National Park Service
Glacier National Park, Montana
Crown of the Continent Research Learning Center

Weed Warriors Wanted!



Help us Preserve Glacier's Diverse Community of Native Plants!

Join us for Glacier National Park's fourth annual Noxious Weed Blitz! We will learn how to identify 5 targeted invasive plant species in the morning followed by mapping and pulling weeds in the afternoon. Please bring gloves, appropriate footwear, and drinking water.

Tuesday, July 23, 2013 10:00 a.m. – 4:00 p.m.

Community Building, West Glacier, MT

Lunch provided by the Glacier National Park Conservancy!

Please RSVP to glac_citizen_science@nps.gov or 406-888-7986

2013 Invasive Plant Participants

Participants	Number of surveys	Number of people in group	Appreciation certificate sent	Notes
Bev O'Brien	3	1		
Bill O'Brien	3	1		
Bob Chinn	1	1		
Brian Johnson	6	1		
Dee Blank	1	1		
Elizabeth Flesch	2	1	n/a	
Flathead High School	1	9	n/a	
Heather Jameson	2	1		
Jami Belt	3	1	n/a	
Jeannie Siegler	3	1		
Julie Bennett-Hudel	13	3		additional participants (Jonathan Hickling, C. Hudel)
MCC crew	5	10		
Racheal Headley	1	1		
Sonja Hartmann	1	1		
Weed Blitz Participants	1	11	n/a	
Total Participants		**44**		

Common Loon Citizen Science Project

2013 Summary

- Loon citizen scientists contributed over 3,003 hours of survey effort
- Citizen scientists completed 238 loon surveys
- We conducted 12 training sessions (including outreach groups who conducted surveys) with 48 participants. Three returning citizen scientists went through training as a refresher during group surveys or one-on-one sessions
- 112 citizen scientists conducted loon surveys

Common Loon monitoring results

Season Long

During 2013 citizen scientists conducted at least 3 surveys at all priority 1, 2 and 3 loon lakes and surveyed all 45 loon lakes. We conducted spring loon surveys at 25 lakes to determine territorial status of loons on each lake.

Throughout the course of the season 47 resident adults and 8 chicks were observed. The adults were comprised of 17 pairs and 13 singles with the 8 chicks being in 6 broods. The North Fork had 5 successful nests and the Lake McDonald area had 1 successful nests. Unsuccessful nesting areas included 1 in the Many Glacier area and 2 in the North Fork. The number of chicks seen season long this year was equal to the number of loons detected during loon days. A banded loon was reported on Bowman Lake, our first record of a banded loon ever in Glacier National Park. The band returns indicated that the adult male loon was banded at Teepee Lake in the Whitefish Range outside of the park and had lost its territory at that lake.

Loon day

During Loon Days there were 20 observers contributing 264 hours to survey all of the 45 lakes. There were 34 adults seen (10 pairs and 14 singles), and 8 chicks observed. 1 chick was seen on Hidden Meadow, 1 on Logging, 1 on Howe, 2 on Middle Quartz, 2 on Winona and 1 on Quartz Lake. The chick on Quartz Lake represents the first record of nesting on that lake since monitoring began in 1988. This compares 40 adults, 15 pairs, and 7 chicks observed in 2012.

2013 Loon Days vs. Season Long

Priority 1	July Loon Days	Season Long
Doverspike	0	1 pair, failed nest
Elizabeth	1 adult	1 pair
Grace	1 pair	1 pair
Harrison	1 adult	1 adult
Hidden Meadow	1 pair, 1 chick	1 pair, 1 chick, 1 brood
Howe	1 pair, 1 chick	1 pair, 1 chick, 1 brood
Kintla	2 pairs	1 pair
Lake McDonald	1 pair	1 adult
Logging	1 adult, 1 pair, 1 chick	1 pair, 1 chick, 1 brood
Lower Quartz	0	0
Middle Quartz	1 adult, 2 chicks	1 pair, 2 chicks, 1 brood
Rogers	1 pair	1 pair
Swiftcurrent	0	0
Trout	0	1 pair, failed nest
Winona/Mud	1 pair, 2 chicks	1 pair, 2 chicks, 1 brood
Babb Beaver Pond	1 adult	1 pair, failed nest
Lower St. Mary	0	0
Total	**9 pairs, 5 Singles, 7 Chicks**	**12 Pairs, 2 Singles, 7 Chicks, 5 Broods**

Priority 2	July Loon Days	Season Long
Bowman	0	1 pair, banded loon seen
Quartz	2 loons, 1 chick	1 pair, 1 chick, 1 brood
Red Eagle	1 loon	1 adult
Total	**0 Pairs, 3 Singles, 1 Chicks**	**2 Pairs, 1 Single, 1 Chick, 1 Brood**

Priority 3	July Loon Days	Season Long
Akokala	1 adult	1 adult
Arrow	0	1 adult
Glenns	1 pair	1 pair
Lower Two Medicine	1 adult	1 adult
Sherburne	0	1 adult
Upper Kintla	1 adult	1 adult
Total	**1 Pair, 3 Singles, 0 Chicks**	**1 Pair, 5 Singles, 0 Chicks**

Priority 4	July Loon Days	Season Long
Avalanche	0	1 adult
Bullhead	0	0
Cosley	0	1 adult
Fishercap	0	0
Grinnell	0	0
Helen	0	0
Janet	0	0
Josephine	1 adult	1 pair
Kootenai	0	
Mokowanis	0	
Redrock	0	
St. Mary	0	1 pair
Two Medicine	0	0 Loons
Waterton	1 adult	1 adult
Total	**0 Pairs, 2 Singles, 0 Chicks**	**2 Pairs, 3 Singles, 0 chicks**

Priority 5	July Loon Days	Season Long
Fish	0	0
Frances	1 adult	1 adult
Hidden	0	0
Johns	0	0
Upper Two Medicine	0	1 adult
Total	**0 Pairs, 1 Single, 0 Chicks**	**0 Pairs, 2 Singles, 0 Chicks**

Totals

Lakes	Loon Days	Season Long
45	**10 Pairs, 14 Singles, 8 Chicks**	**17 Pairs, 13 Singles, 8 Chicks, 6 Broods**

Methods for determining territorial loon population

Updated on 10/30/2013

One of the primary project objectives was to determine the number of Common Loons residing in Glacier National Park each year. With a large dataset and repeated visits to each lake it was necessary to analyze each lake on an individual basis to determine the number of resident loons present. In order to calculate fecundity and compare our data with the Montana Fish, Wildlife and Parks data from the rest of the state, we need to identify how many territorial pairs we have. Because we are unable to observe loons at all of our priority 1, 2 and 3 lakes during the courtship/ nesting season, we use residential loons as a surrogate for territorial loons when nesting, courtship, or other forms of territoriality are not confirmed.

Surveys with questionable data were omitted during analysis. Data were considered questionable when sightings reported seem contrary to typical loon behavior and verification of the data wither failed to produce similar results or was impossible to conduct. When it was not possible to verify data due to logistical reasons the Project Coordinator contacted the citizen scientist to ask questions that may illuminate whether the data were valid based on the observer's description and bird identification skill level. However, all questionable data were omitted during analyses unless verified directly but were retained in the full dataset. A few examples of questionable data reports are more than 2 chicks sighted on one lake, reported lack of binoculars, groups of subadults, or reported uncertainty of observers.

Also during analysis, for surveys conducted by the same observer over consecutive days the highest count of loons seen during each three day period was counted as one survey. A series of judgment-based decisions was made in order to select a survey for each lake that appeared to be representative of the resident population.

The steps were as follows:

1. If a brood was observed by at least one observer and verified by at least one observer, that lake was determined to have a resident brood.
2. If a single loon was observed during at least one-third of the surveys on a given lake that lake was determined to have a resident single loon.
3. If a pair of loons was observed during at least one-third of the surveys on a given lake that lake was determined to have a resident pair.
4. If more than one pairs of loons was observed during at least one-third of the surveys on a given lake, that lake was determined to have two resident pairs.
5. In cases of lakes with poor access or visibility, or lakes that were very large in size, the survey that covered the lake most thoroughly, was conducted by the most skilled observer *and* took place closest to Loon Day was determined to be representative of the resident population.

2013 Loon Nesting Results

Babb: 1 territorial pair, nested and hatched (chicks not fledged), failed re-nest
Hatch Date: 6/1/13 - 6/13/13
Possible Cause of Failure: Unknown
A pair was first seen on Babb Beaver Pond in early May, but were not performing any nesting behaviors. Nesting was first identified 5/20 at the same nesting site as the previous year. On 6/1 the pair was seen at the lake, but was not seen on a nest. On 6/13 a loon was observed fighting with a beaver, while in another area two chicks were sighted. The chicks were not photographed but were reported by Betty Kijewski, a wildlife technician in the park. By 6/15 the chicks were no longer seen. The pair was photographed on a new nest in a different area. They stayed on the nest until early July, and no other reproductive activity was seen again.
UTMs: First Nest- 320570E, 5413785N Second Nest- 320570E, 5413785N



First nest, 5/20/13



Second nest, 6/15/13



Pair nest exchange, 6/15/13

Doverspike: 1 territorial pair, failed nest
Possible Cause of Failure: Flooding
During the first survey for Doverspike on 5/21 a nest was seen, but the following survey in 6/19 had a pair that was not nesting. By Loon Days there were no loons on the lake. The observer speculated that the nest was flooded, as the nest was underwater.
UTMs: Nest Site- 255105E, 5417010N



Nest detected on 5/21/2013

Hidden Meadow: 1 territorial pair, successful nest, 1 chick in 1 brood
Hatch Date: 6/11/13- 7/7/13
On 5/24 a pair was seen fishing together. On 6/11 one of the loons from the pair was believed to be on a nest but was not spotted again. By the next survey in 7/7, the pair had one downy young with them that was attempting to dive. This young was very close to the small young age class but still a downy young, putting it at about 3 weeks of age. The nest site was not located.
UTMs: Nursery Area- 262368E, 5405457N


Pair seen 5/24/13



Adult and large chick, 8/15/13

Howe: 1 territorial pair, successful nest, 1 chick in 1 brood
Hatch Date: 5/20/13- 6/26/13
The pair was first spotted 4/30 but was not yet nesting. On 5/9 nesting habitat was identified, but not confirmed until 5/20. The chick was first seen 6/25 in the downy young stage, and on 6/29 it was classified as a small young, plausibly putting this chick at 3 to 4 weeks in age. By on 7/21 it was classified as large young. On August 15th no loons were found on Howe Lake.
UTMs: Nesting Habitat- 279856E, 5387902N Nest Site- 279516E, 538700N
Nursery Area- 279833E, 5388009N


Nest, 5/24/13


Adult and small chick, 6/29/13


Adult and large chick, 7/21/13

Logging: 1 territorial pair, failed nest, successful re-nest, 1 chick in 1 brood
Hatch Date: 6/28/13- 7/20/13
Cause of Failure: Predation on nesting adult
On 5/15 a pair of loons was seen at both the head and the foot of the lake. On 5/17 a nest was found just north of the boat house at the lower cabin. Between the surveys on 5/17 and 5/30, one of the adult loons was found dead on the nest with no eggs. This was discovered by backcountry rangers when they were attempting to place a resource closure sign to protect the nest site. On 5/30 the dead loon was retrieved, and is believed to have been killed by an aerial predator. The

carcass was unsuitable for a full necropsy but feathers will be retained for further mercury testing. Surveys performed between 5/30 and 7/20 saw only a lone loon on the lake. Loon Days surveys on 7/20 and 7/21 found a pair of loons with one small young. It is believed this could either be the pair from the head of the lake, a new pair altogether, or the adult left from the original pair found a new mate and renested. A second nest site was not located.
UTMs: Original Nest- 269891E, 5403351N Nursery Area- 270457E, 5403806N



Original nest 5/17/13



Failed nest site 5/30/13



Loon carcass, 5/30/13



Loon pair with small chick, 7/20/13

Middle Quartz: 1 territorial pair, successful nest, 2 chicks in 1 brood
Hatch Date: 6/1/13- 7/20/13
The nest on Middle Quartz was first seen on 6/1, and was on an island in the lake. The lake was not surveyed again until 7/20, when two large chicks was seen with one adult. It is believed the other parent could have been foraging elsewhere, either on the Middle Quartz Lake or another lake.

UTMs: Nest Site- 269292E, 5412493N Nursery Area- 269098E, 5412638N

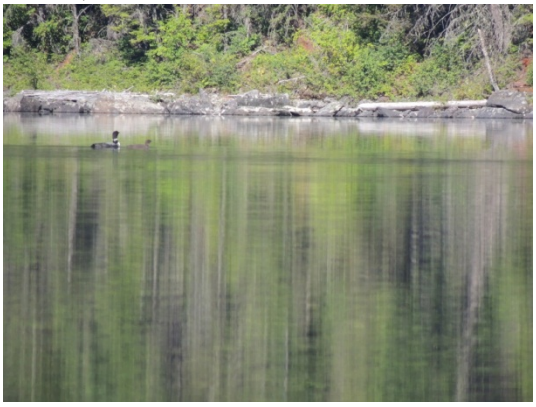


Loon nest, 6/1/13



Adult loon and large chick, 7/20/13

Quartz (Upper): 1 territorial pair, successful nest, 1 chick in 1 brood
Hatch Date: 6/1/13- 7/21/13
Due to the challenge of doing surveys on Quartz Lake, all of the surveys performed before loon days were either from only the foot of the lake, or reports from untrained staff members from the park and USGS fisheries crew. All of the surveys before 7/20 reported one lone adult. The fisheries crew had reported a possible nest toward the head of the lake, but these were uncertain reports. On 7/21 a volunteer canoed to the head of the lake and saw one individual toward the foot and an adult with a small chick at the head of the lake. The nest site was not located.
UTMs: Nursery Area- 275159E, 541495N



Adult loon and small chick, 7/21/13

Trout: 1 territorial pair, failed nest
Possible Cause of Failure: Flooding
The nest on Trout Lake was first seen on 6/5, which was located on a very small island of grass and trees. Several surveys followed up on 6/9 and 6/11 with the same results. On 7/12 a survey resulted in finding a pair of loons on the lake in the vicinity of the nest site, but with no chicks. From what could be seen, no eggs were in the nest, but evidence from the collected surveys points to flooding as the main plausible cause of nest failure. A survey on 7/20 found no loons on the lake.

UTMs: Nest Site- 285215E, 5394966N



Loon nest, 6/9/13



Loon pair, 7/12/13



Failed nest site 7/12/13

Winona: 1 territorial pair, successful nest, 2 chicks 1 brood
Hatch Date: 6/11/13- 7/7/13

A pair was seen on Winona Lake during the first survey of the year on 5/2. This pair was in the same area as last year's nesting site and seemed to be scouting the location of a possible nest site for this year. On 5/17 the pair was officially nesting. The two chicks were first seen on 7/7 as downy young. By 7/17 the chicks were classified as large young.

UTMs: Nesting Habitat- 261829E, 5402401N Nest- 261868E, 5402689N
Nursery Area- 262067E, 5402204N



Large young, 7/19/13

2013 Loon Days Results

Priority 1	July Loon Days	Observer
Doverspike	0 loons	Steve Gniadek
Elizabeth	1 loon	Jami Belt
Grace	1 pair	Taylor Hanson
Harrison	1 loon	John Kyle
Hidden Meadow	1 pair, 1 chick	Bob Chinn
Howe	1 pair, 1 chicks	Kathy Ross
Kintla	2 pairs	Sheree West
Lake McDonald	1 pair	Bob Chinn
Logging	1 adult, 1 pair, 1 chick	Taylor Hanson
Lower Quartz	0 loons	Brian Johnson
Middle Quartz	1 adult, 2 chicks	Brian Johnson
Rogers	1 pair (2 adults)	Elizabeth Flesch
Swiftcurrent	0 loons	Barbara Summer
Trout	0 loons	Elizabeth Flesch
Winona/Mud	1 pair, 2 chicks	Bob Chinn
Babb Beaver Pond	1 loon	Barbara Summer
Lower St. Mary	0 loons	Khrystyne Jamerson
Total	**9 pairs, 5 singles, 7 chicks**	

Priority 2	July Loon Days	Observer
Bowman	0 loons	Kathy Gallagher
Quartz	1 adult, 1 chick	Brian Johnson
Red Eagle	1 loon	Dow Stephens
Total	**0 pairs, 3 singles, 1 chick**	

Priority 3	July Loon Days	Observer
Akokala	1 loon	Susie Waldron
Arrow	0 loons	Elizabeth Flesch
Glenns	0 loons	Elizabeth Flesch
Lower Two Medicine	1 loon	Khrystyne Jamerson
Sherburne	0 loons	Theresa Steele
Upper Kintla	1 loon	Sheree West
Total	**1 pair, 3 singles, 0 chicks**	

Priority 4	July Loon Days	Observer
Avalanche	0 loons	Don Zinn
Bullhead	0 loons	Theresa Steele

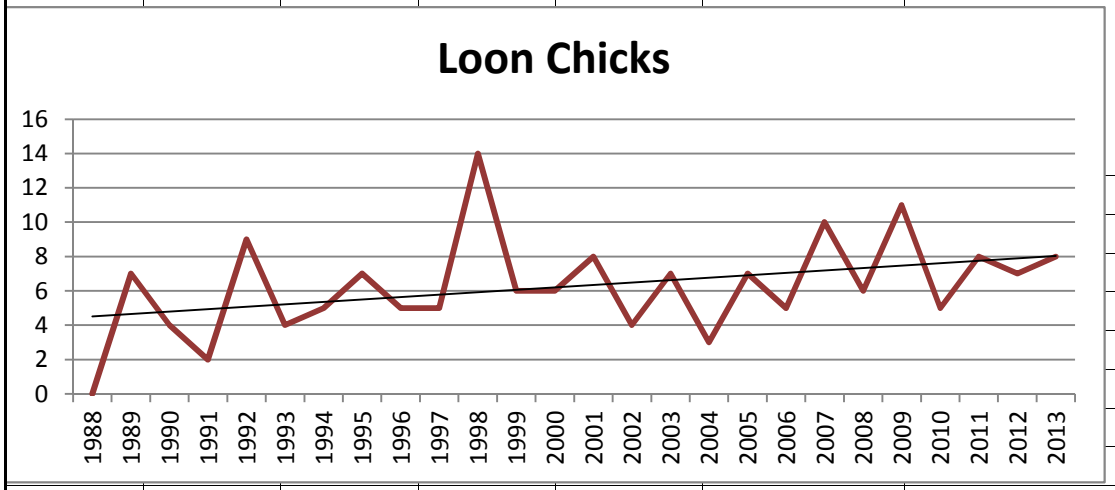
Cosley	1 pair	Elizabeth Flesch
Fishercap	0 loons	Theresa Steele
Grinnell	0 loons	Barbara Summer
Helen	0 loons	Jami Belt
Janet	0 loons	Terry Peterson, Nancy Lundgren
Josephine	1 loon	Barbara Summer
Kootenai	0 loons	Terry Peterson, Nancy Lundgren
Mokowanis	0 loons	Elizabeth Flesch
Redrock	0 loons	Theresa Steele
St. Mary	0 loons	Khrystyne Jamerson
Two Medicine	0 loons	Don Zinn
Waterton	1 loon	Terry Peterson, Nancy Lundgren
Total	**0 pairs, 2 singles, 0 chicks**	

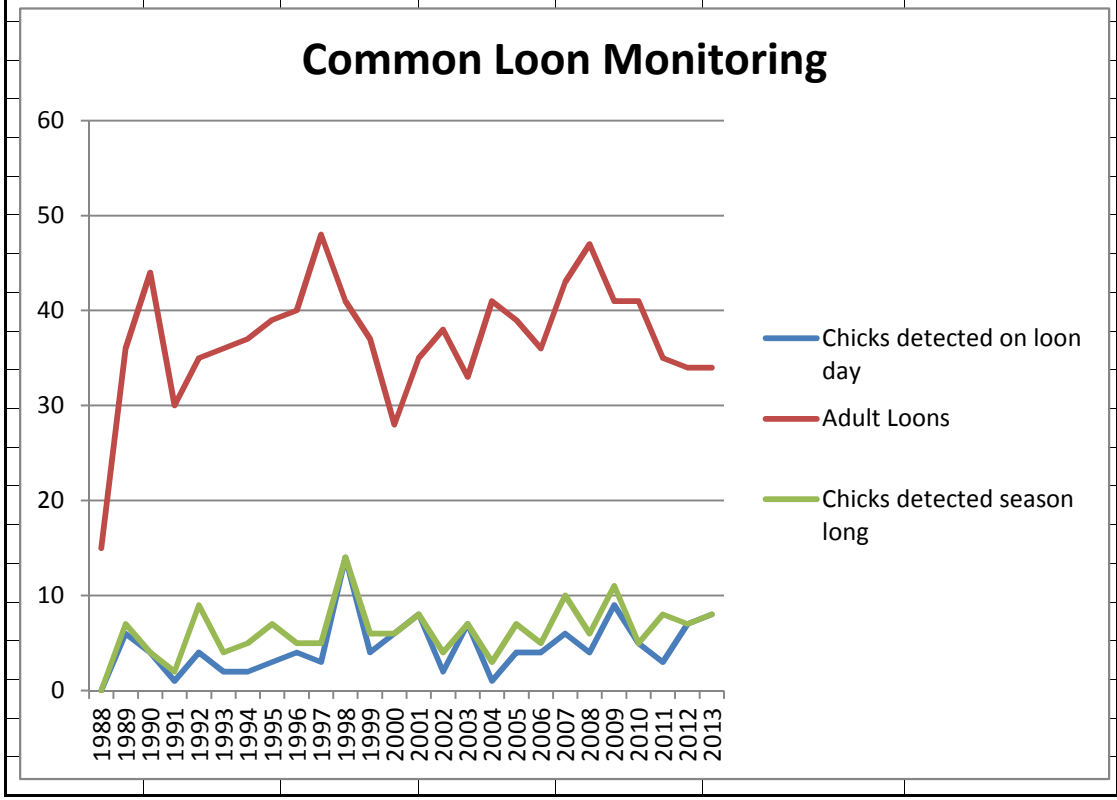
Priority 5	**July Loon Days**	**Observer**
Fish	0 loons	Becky Williams
Frances	1 loon	Terry and Nancy
Hidden	0 loons	Clayton Mauritzen
Johns	0 loons	Bob Chinn
Upper Two Medicine	0 loons	Don Zinn
Total	**0 pairs, 1 single, 0 chicks**	

Totals

Lakes	**Loons**	**Volunteers**
45	**10 Pairs, 14 Singles, 8 Chicks**	**20 Observers, 264 Hours**

Common Loon Trends 1988- 2013





Loon Day Year	# Adult loons on loon day	# Chicks on Loon Day	# Chicks detected before or after Loon day	Detection rate for Loon Day
1988	15	0	0	1.00
1989	36	6	7	0.86
1990	44	4	4	1.00
1991	30	1	2	0.50
1992	35	4	9	0.44
1993	36	2	4	0.50
1994	37	2	5	0.40
1995	39	3	7	0.43
1996	40	4	5	0.80
1997	48	3	5	0.60
1998	41	14	14	1.00
1999	37	4	6	0.67
2000	28	6	6	1.00
2001	35	8	8	1.00
2002	38	2	4	0.50
2003	33	7	7	1.00
2004	41	1	3	0.33
2005	39	4	7	0.57
2006	36	4	5	0.80
2007	43	6	10	0.60
2008	47	4	6	0.67
2009	41	9	11	0.82
2010	41	5	5	1.00
2011	35	3	8	0.38
2012	34	7	7	1.00
2013	34	8	8	1.00
0.74		121	163	18.86
Average Detection Rate of Chicks on Loon Day= 0.7				

Logging Drainage Citizen Science Loon Monitoring Summary
Provided for preparation of compliance for Logging Lake Removal of Lake Trout Project

2013 Nesting History
Logging- 1 breeding pair, 1 chick in one brood (re-nest after initial nest failure)

2012 Nesting History
Logging- 2 resident pairs, no chicks detected, failed nest at foot of lake
Nest at foot of lake active between 6/7- 6/10 then inactive by the end of June.

2011 Nesting History
Logging- 1 resident pair, no chicks detected
Relatively inadequate survey coverage as we were limited in our ability to schedule use of the canoe.

2010 Nesting History
Logging- 2 resident pairs, no chicks detected

2009 Nesting History
Logging- 3 resident pairs (1 breeding pair), 1 chick
Pair 1- mid lake
hatch date: before 7/13
migration dates: chick and both adults after 9/11

2008 Nesting History
Logging- three resident pairs (1 breeding pair, 2 territorial pair), 1 chick in one brood
(congregations of up to 6 loons observed)
Pair 1-one chick hatched, nest site observed
hatch date: between 7/2/08 & 7/9/08
migration dates:
Pair 2- territorial pair, nest attempt unknown
Pair 3- territorial pair, nest attempt unknown

2007 Nesting history
Logging- three resident pairs (2 breeding pairs, 1 territorial pair), three chicks in two broods
Pair 1-two chicks hatched, nest site not observed
hatch date brood 1: 6/23 to 7/6
Pair 2- one chick hatched, nest site observed
hatch date brood 1: 7/7 to 9/1 (nest incubation observed on 7/7, chick not detected during subsequent surveys until 9/1)
Pair 3- territorial pair, nest attempt unknown
migration dates: unknown (3 pairs still present as of last survey on 9/4/2007)

2006 Nesting History
Logging- 2 resident pairs, no chicks detected

Grace Lake Citizen Science Loon Monitoring Summary

2009 Nesting History
Grace – 1 resident pair with 2 chicks
Hatch date between 6/30/2009 and 7/14/ 2009
First record of breeding on this lake.

2010 Nesting History
Grace- 1 resident pair, 2 chick
Hatch date: between 5/8/2010 and 6/30/2010

2011 Nesting History
Grace- 1 resident pair, 2 chicks
Hatch Date: prior to 6/25/2011

2012 Nesting History
Grace- 1 resident pair, no chicks

2013 Nesting History
Grace- 1 residential pair, no chicks

LAKE	DATE	OBSERVER	ADULTS	YOUNG	COMMENTS
Logging Lake	7/16/1988	unknown	3	0	
Logging Lake	7/16/1989	Gniadek, Steve	8	0	ONLY 2 LOONS SEEN ON LOON DAY
Logging Lake	7/14/1990	unknown	7	0	
Logging Lake	7/13/1991	unknown	2	0	
Logging Lake	7/18/1992	Lang, Scott	5	0	
Logging Lake	7/17/1993	Altop, Regi	5	0	
Logging Lake	7/16/1994	Emmerich, Scott	2	0	
Logging Lake	7/15/1995	Gard, D.	2	0	
Logging Lake	7/20/1996	Lang, Scott & LaFleur, Dawn	4	0	
Logging Lake	7/18/1998	Hahr, Meg	5	2	
Logging Lake	7/17/1999	Victor, M.	2	1	Survey time 0645-1230.
Logging Lake	7/17/1999	Victor, M.	3	0	Survey time 0645-1230.
Logging Lake	7/29/1999	Schmitz, Stephanie & Hahr, Meg	1	1	Survey time 1700.
Logging Lake	7/16/2000	Greene, Jim & Vogt, Martha	3	0	
Logging Lake	7/21/2001	Greene, Jim & Vogt, Martha	4	1	
Logging Lake	7/20/2002	Greene, Jim & Vogt, Martha	6	0	obs btwn 1000-1400. 1100 pair diving/feeding, 1230 single loon diving/feeding, 1300 single loon diving/feeding, 1400 pair sleeping/loafing.
Logging Lake*	8/13&15/02	Gniadek, Steve	1*(8/13& 14)	2*(8/13& 14)	NOT ON LOON DAY. Two small dark chicks observed w/single adult on August 13 &14.

Quartz Drainage Citizen Science Loon Monitoring Summary
Provided for preparation of compliance for Quartz Lake Removal of Lake Trout Project

2006 Nesting History
Lower Quartz- resident pair
Middle Quartz- no resident loons
Quartz- single resident loon, up to 7 adults observed during a single survey

2007 Nesting History
Lower Quartz Lake- 1 breeding pair, 2 chicks
Middle Quartz Lake- 1 breeding pair, 2 chicks
Quartz Lake- 1 territorial pair, up to 9 adults observed during a single survey

2008 Nesting History
Lower Quartz- no resident loons
Middle Quartz- breeding pair, 1 chick, nest site observed
hatch date: between 6/17/08 & 6/24/08
Quartz- no resident loons, up to 3 adults observed during a single survey

2009 Nesting History
Lower Quartz – 1 breeding pair, 2 chicks
Hatch date: between 6/23 and 7/14
Middle Quartz – 1 breeding pair, 2 chicks
Hatch date: between 6/13 to 6/20
Quartz- 1 resident pair

2010 Nesting History
Lower Quartz- 1 resident pair, nest failed.
Middle Quartz- 1 resident pair, 2 chicks
Hatch date: between 6/23 to 7/17
Quartz- single resident adult, up to 3 adults observed during a single survey

2011 Nesting History
Lower Quartz: 1 breeding pair, 1 chick. Fishing closure along foot of lake implemented during nesting season. Hatch date: between 6/13 to 7/17
Middle Quartz- no resident loons
Quartz- 2 resident pairs, up to 6 loons observed during a single survey

2012
Lower Quartz: 1 breeding pair, nest failed. Fishing closure along foot of lake implemented during nesting season until nest failure was documented (5/28- 6/25)
Middle Quartz: 1 breeding pair, 1 chick
Hatch date: between 6/15 to 6/30
Quartz- single resident loon, up to 3 adults seen during single survey

2013

Lower Quartz: 1 single loon

Middle Quartz: 1 breeding pair, 2 chicks in 1 brood

Hatch date: between 6/1 to 7/20

Quartz- 1 breeding pair, 1 chick in 1 brood

Hatch date: between 6/1 to 7/21

Lake	Date	Year	Observer	Adults	Young	Comments
Quartz Lake	7/16/1988	1988	unknown	0	0	
Quartz Lake	7/15/1989	1989	unknown	1	0	
Quartz Lake	7/14/1990	1990	unknown	4	0	
Quartz Lake	7/13/1991	1991	unknown	1	0	
Quartz Lake	7/27/1992	1992	McClelland, Riley	3	0	
Quartz Lake	7/17/1993	1993	Kingsley, N & A-L	3	0	
Quartz Lake	7/16/1994	1994	Mueller,Matt	1	0	"INCOMPLETE SURVEY"
Quartz Lake	7/15/1995	1995	Haggerty, Pat	2	0	
Quartz Lake	7/20/1996	1996	Haggerty, Pat	2	0	
Quartz Lake	7/18/1998	1998	Altop, Regi	3	0	
Quartz Lake	7/17/1999	1999	Lang, Scott	1	0	Survey time 0900.
Quartz Lake	7/17/1999	1999	Lang, Scott	1	0	Survey time 0900. Bald eagle seen on Quartz Lake ~3/4 up lake; BAEA seen dive bombing common loon at foot of Quartz by trail crew on 7/16/99.
Quartz Lake	7/16/2000	2000	Ford, Matt	1	0	
Quartz Lake	7/21/2001	2001	Lang, Scott	1	0	
Quartz Lake	7/20/2002	2002	Emmerich, Scott	3	0	obs btwn 0700-0900. Three adult loons swimming in same area btwn 0730-0735.

GLACIER NATIONAL PARK LOON OBSERVATION FORM

Lake Name _____ Observers_____ Date _____

Address_____ Phone_____ E-mail _____

Weather (temp., wind, precip…)_____ Time Observed (Start/Stop)_____

Volunteer Loon Observer Service Hours (total driving, hiking and observation time) Start Time_____ Stop Time_____

Summary

of Pairs_____ **# of Singles**_____ **Total Adults**_____ **# of Subadults**_____ **# of Chicks/Juveniles**_____

(brown & white adult-sized bird) **(young of the year)**

Chick Stage: (Downy young) (Small young) (Large young)

People **(on shore)**_____ **#/type of Boats** **(in water)**_____ **Confirmed Nesting** **(Y/N)**_____ **Nest Status:** (Incubating) (Abandoned) (Hatched)

Significant Observations _____

GPS locations of nest site or other significant observations (in NAD 83)_____

BANDED BIRDS? Color of Bands **Loon: (A1, C1…)** _____ **Left Leg: closest to body**_____**/ closest to foot**_____ **Right Leg: closest to body**_____**/ closest to foot**_____

Space to sketch map:

Return form within one week of observation to:

Mailing address: GNP-CCRLC
Citizen Science Loon Project
P.O. Box 128
West Glacier, MT 59936
Fax: (406) 888-7903
Email: GLAC_Citizen_Science@nps.gov
Phone: (406) 888-7986

FILL IN TABLE ON PAGE 2

INSTRUCTIONS: 1. On the other side, fill out the general information, the summary box, and sketch a map (or use an attached map). Locate and label loon locations, nesting areas, nursery areas, observation points and watercraft on the map. 2. Note significant observations of loon interactions, nesting, chick rearing, loon/human interactions, predators, eagles, ravens, and other waterfowl. Loon behaviors using timed intervals may also be indicated in the lower table. 3. Do not record behaviors in lower table if loons are reacting to your presence; record this on the Significant Observations line in the Summary box.) 4. Note the presence of natural nests. **5. If you don't observe any loons, please note the absence of loons.**

Loon Behavior Key:

B1 Diving/feeding, self
B2 Diving/feeding, chick
B3 Swimming
B4 Preening
B5 Sleeping/loafing
B6 Flying
B7 Call – tremolo
B8 Call – wail
B9 Call - hoot
B10 Call – flight tremolo
B11 Chick riding on adult
T1 Call – yodel (territorial)
T2 Call – tremolo/yodel
T3 Territorial – approach
T4 Territorial – raised neck
T5 Territorial – upright wingflap
T6 Territorial - circling, bill dipping, diving
T7 Territorial – penguin dance
T8 Territorial – surface rush
T9 Territorial – chasing/attack
T10 Territorial – harassment diving
M1 Courtship – mutual bill dipping/diving
M2 Courtship – ashore nest test
M3 Courtship – copulation
N1 Nesting – nest building
N2 Nesting – incubation
N3 Nesting – left nest

Time Interval (Start) (Stop)	Adult 1 (A1) of pair	Adult 2 (A2) of pair	Other Adults (A3, A4…)	Chick 1 (C1)	Chick 2 (C2)	# People on Shore	#/ type Boats in Water	Eagles or Ravens in the area?	Comments
10:15-10:25	**B1, T2**	**N1**				**12**	**3 (canoe)**	**Y (2 eagles)**	**EXAMPLE**

BEHAVIOR DEFINITION

T1) Yodel – Territorial call given by the male loon, usually given when another male flies over the territory or in a territorial encounter.

T3) Approach – A pair approaching an intruder loon, other waterfowl or boat

T4) Raised Neck – A heightened alertness and is an easy clue that something is disturbing the birds.

T5) Upright Wing-flap – The loons to rise up out of the water and flap their wings with white breasts towards the intruder. This is a long distance signal to an intruder (loon or boat) that the territory is occupied.

T6) Circling – The resident pair and the intruder loon move around each other in a circle.
Bill Dipping – A repeated sequence of raising the neck/head and a dipping of the face into the water. A nervous gesture, which occurs as the loons come within a close distance of the intruder.
Mutual Dive – Jerky head movements followed by shallow dives by 1 or more loons.

T7) Penguin Dance –The birds raise up vertically out of the water, treading water with their feet. Sometimes they slap the water with their wings. This is the most aggressive territorial behavior.

T8) Surface Rush – Usually follows Penguin Dance. The "dancing" bird falls forward into the water and continues the momentum as an underwater torpedo.

T9) Chasing – Occurs on the surface as the loon uses their wings in an "oaring" motion to chase off an intruder.
Attack – Loons will attack other birds, such as grebes.

T10) Harassment Diving– Loons will harass waterfowl by diving and resurfacing under the offending bird.

Revised: May 14, 2010

Common Loon Citizen Science
Volunteer Hours

Loon_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
2658	AKOKALA	6/6/2013	2	7:30	18:00	10.50	21.00
2784	AKOKALA	7/21/2013	1	7:00	18:00	11.00	11.00
3029	AKOKALA	10/23/2013	1	11:30	14:30	3.00	3.00
2659	ARROW	6/12/2013	3	7:30	18:45	11.25	33.75
2815	ARROW	7/21/2013	1	6:00	15:00	9.00	9.00
2893	ARROW	9/17/2013	4	7:00	17:00	10.00	40.00
2786	AVALANCHE	7/22/2013	1	9:30	14:00	4.50	4.50
2832	AVALANCHE	7/23/2013	1	8:00	19:45	11.75	11.75
2869	AVALANCHE	8/10/2013	1	7:00	14:30	7.50	7.50
2878	AVALANCHE	8/25/2013	2	6:00	13:00	7.00	14.00
2886	AVALANCHE	8/29/2013	1	8:00	14:30	6.50	6.50
2663	BABB BEAVER POND	4/16/2013	1	9:00	15:00	6.00	6.00
2660	BABB BEAVER POND	5/6/2013	1	7:00	9:40	2.67	2.67
2661	BABB BEAVER POND	5/14/2013	1	7:00	19:30	12.50	12.50
2664	BABB BEAVER POND	5/20/2013	1	6:30	17:30	11.00	11.00
2665	BABB BEAVER POND	6/1/2013	1	6:30	18:30	12.00	12.00
2751	BABB BEAVER POND	6/13/2013	1	7:00	17:00	10.00	10.00
2662	BABB BEAVER POND	6/15/2013	1	13:00	18:00	5.00	5.00
2757	BABB BEAVER POND	7/7/2013	1	14:00	20:00	6.00	6.00
2758	BABB BEAVER POND	7/8/2013	1	7:00	12:00	5.00	5.00
2817	BABB BEAVER POND	7/20/2013	1	4:00	18:30	14.50	14.50
2668	BOWMAN	5/26/2013	2	8:00	8:20	0.33	0.67
2669	BOWMAN	6/6/2013	2	7:30	18:00	10.50	21.00
2750	BOWMAN	6/20/2013	1	7:00	17:00	10.00	10.00
2746	BOWMAN	6/27/2013	1	7:30	17:30	10.00	10.00
2747	BOWMAN	6/27/2013	1	7:30	17:30	10.00	10.00
2748	BOWMAN	6/27/2013	1	7:30	17:30	10.00	10.00
2768	BOWMAN	7/13/2013	2	4:45	13:00	8.25	16.50
2769	BOWMAN	7/14/2013	2	7:00	14:30	7.50	15.00
2826	BOWMAN	7/19/2013	11	14:00	18:00	4.00	44.00
2816	BOWMAN	7/21/2013	2	6:15	18:00	11.75	23.50
2849	BOWMAN	8/15/2013	2	6:30	18:30	12.00	24.00
2759	BULLHEAD	7/8/2013	1	8:20	13:20	5.00	5.00
2810	BULLHEAD	7/21/2013	1	6:30	21:45	15.25	15.25
2850	BULLHEAD	8/8/2013	1	8:45	19:00	10.25	10.25
2890	BULLHEAD	9/13/2013	1	7:15	21:00	13.75	13.75
2892	BULLHEAD	9/16/2013	2	8:15	20:00	11.75	23.50
2671	COSLEY	5/27/2013	2	10:15	23:59	13.73	27.47
2760	COSLEY	6/17/2013	1	6:30	19:30	13.00	13.00
2833	COSLEY	7/23/2013	1	8:15	17:30	9.25	9.25
2834	COSLEY	7/24/2013	1	8:15	17:30	9.25	9.25

Common Loon Citizen Science
Volunteer Hours

Loon_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
2851	COSLEY	8/7/2013	2	15:15	17:30	2.25	4.50
2852	COSLEY	8/9/2013	1	9:20	15:00	5.67	5.67
2871	COSLEY	8/23/2013	2				0.00
2673	DOVERSPIKE (ROUND PRAIRIE)	5/21/2013	1	9:00	16:00	7.00	7.00
2672	DOVERSPIKE (ROUND PRAIRIE)	6/19/2013	1	9:00	16:30	7.50	7.50
2802	DOVERSPIKE (ROUND PRAIRIE)	7/20/2013	1	7:00	14:00	7.00	7.00
2846	ELIZABETH	6/16/2013	1	8:00	20:00	12.00	12.00
2798	ELIZABETH	7/20/2013	2	14:40	20:30	5.83	11.67
2853	ELIZABETH	8/8/2013	1	8:30	18:30	10.00	10.00
2873	ELIZABETH	8/24/2013	1	14:00	23:15	9.25	9.25
2749	FISH	7/1/2013	1	6:00	13:30	7.50	7.50
2808	FISH	7/20/2013	1	7:15	13:00	5.75	5.75
2743	FISHERCAP	6/27/2013	1	7:00	17:00	10.00	10.00
2761	FISHERCAP	7/7/2013	1	13:00	17:00	4.00	4.00
2812	FISHERCAP	7/21/2013	1	6:30	21:45	15.25	15.25
2854	FISHERCAP	8/8/2013	1	8:45	19:00	10.25	10.25
2891	FISHERCAP	9/13/2013	1	7:15	21:00	13.75	13.75
2792	FRANCES	7/20/2013	2	17:40	19:00	1.33	2.67
2794	FRANCES	7/21/2013	2	7:20	9:20	2.00	4.00
2762	GLENN'S	6/17/2013	1	9:00	18:45	9.75	9.75
2835	GLENN'S	7/24/2013	1	8:15	17:30	9.25	9.25
2855	GLENN'S	8/7/2013	1	11:15	12:45	1.50	1.50
2856	GLENN'S	8/7/2013	1	12:45	15:15	2.50	2.50
2857	GLENN'S	8/7/2013	1	8:30	11:15	2.75	2.75
2674	GRACE	5/15/2013	1	14:30	16:00	1.50	1.50
2796	GRACE	7/20/2013	1	7:30	20:00	12.50	12.50
2868	GRACE	8/23/2013	1	19:00	20:00	1.00	1.00
2675	GRINNELL	6/14/2013	3	7:30	13:45	6.25	18.75
2770	GRINNELL	6/28/2013	1	12:00	17:00	5.00	5.00
2820	GRINNELL	7/20/2013	1	5:00	18:30	13.50	13.50
2899	GRINNELL	9/10/2013	1	7:00	15:00	8.00	8.00
2771	HARRISON	7/12/2013	1	7:00	19:00	12.00	12.00
2825	HARRISON	7/20/2013	1	4:30	23:59	19.48	19.48
2883	HARRISON	8/26/2013	2	9:10	23:59	14.82	29.63
2884	HARRISON	8/27/2013	2	9:00	19:45	10.75	21.50
2885	HARRISON	8/29/2013	1	7:15	7:30	0.25	0.25
2799	HELEN	7/20/2013	2	7:00	14:40	7.67	15.33
2785	HIDDEN	7/21/2013	1	13:30	21:15	7.75	7.75
2858	HIDDEN	8/9/2013	1	9:15	20:00	10.75	10.75
2872	HIDDEN	8/24/2013	1	7:00	19:00	12.00	12.00
2887	HIDDEN	8/31/2013	1	7:50	20:10	12.33	12.33
2888	HIDDEN	8/31/2013	2	4:30	17:00	12.50	25.00

Common Loon Citizen Science
Volunteer Hours

Loon_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
2676	HIDDEN MEADOW	5/24/2013	1	7:45	17:00	9.25	9.25
2677	HIDDEN MEADOW	6/11/2013	1	6:50	15:30	8.67	8.67
2753	HIDDEN MEADOW	7/7/2013	1	11:00	19:00	8.00	8.00
2822	HIDDEN MEADOW	7/20/2013	1	11:00	19:30	8.50	8.50
2859	HIDDEN MEADOW	8/15/2013	2	6:30	18:30	12.00	24.00
2904	HIDDEN MEADOW	9/25/2013	2	11:15	16:45	5.50	11.00
2678	HOWE (UPPER)	4/30/2013	3	8:00	14:30	6.50	19.50
2679	HOWE (UPPER)	5/9/2013	1	7:00	14:00	7.00	7.00
2680	HOWE (UPPER)	5/20/2013	2	9:30	18:30	9.00	18.00
2718	HOWE (UPPER)	6/25/2013	1	7:10	19:38	12.47	12.47
2744	HOWE (UPPER)	6/29/2013	1	8:50	17:00	8.17	8.17
2836	HOWE (UPPER)	7/21/2013	2	7:00	17:00	10.00	20.00
2842	HOWE (UPPER)	8/5/2013	1	8:30	14:00	5.50	5.50
2860	HOWE (UPPER)	8/15/2013	1	11:00	16:45	5.75	5.75
2791	JANET	7/20/2013	2	9:30	21:00	11.50	23.00
2876	JANET	8/24/2013	2	10:00	18:30	8.50	17.00
2772	JOHNS	7/11/2013	1	13:00	15:30	2.50	2.50
2837	JOHNS	7/11/2013	2	12:30	14:30	2.00	4.00
2823	JOHNS	7/21/2013	1	12:00	20:20	8.33	8.33
2723	JOSEPHINE	5/15/2013	1	7:30	19:00	11.50	11.50
2681	JOSEPHINE	6/14/2013	4	7:30	13:45	6.25	25.00
2745	JOSEPHINE	6/28/2013	1	7:00	17:00	10.00	10.00
2838	JOSEPHINE	7/3/2013	1	14:15	15:00	0.75	0.75
2819	JOSEPHINE	7/20/2013	1	5:00	18:30	13.50	13.50
2682	KINTLA	6/15/2013	2	6:30	17:30	11.00	22.00
2767	KINTLA	7/8/2013	1	11:30	21:30	10.00	10.00
2773	KINTLA	7/10/2013	1	7:00	19:00	12.00	12.00
2774	KINTLA	7/13/2013	1	9:00	13:00	4.00	4.00
2807	KINTLA	7/19/2013	2	7:00	17:30	10.50	21.00
2827	KINTLA	7/19/2013	12	14:00	18:00	4.00	48.00
2800	KINTLA	7/21/2013	1	5:00	21:10	16.17	16.17
2861	KINTLA	8/13/2013	2	8:30	21:00	12.50	25.00
2901	KINTLA	9/18/2013	2				0.00
2754	KOOTENAI	7/2/2013	2	6:00	22:00	16.00	32.00
2790	KOOTENAI	7/22/2013	2	9:30	19:00	9.50	19.00
2897	KOOTENAI	9/19/2013	1	12:45	16:45	4.00	4.00
2697	LAKE MCDONALD	4/23/2013	2	11:00	14:00	3.00	6.00
2698	LAKE MCDONALD	5/14/2013	2	19:00	21:30	2.50	5.00
2699	LAKE MCDONALD	5/17/2013	5	13:23	16:27	3.07	15.33
2700	LAKE MCDONALD	5/17/2013	5	13:23	16:15	2.87	14.33
2701	LAKE MCDONALD	5/17/2013	3	9:30	16:15	6.75	20.25

Common Loon Citizen Science
Volunteer Hours

Loon_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
2703	LAKE MCDONALD	5/17/2013	5	14:48	16:05	1.28	6.42
2702	LAKE MCDONALD	5/20/2013	1	7:00	18:00	11.00	11.00
2704	LAKE MCDONALD	5/20/2013	1	7:00	18:00	11.00	11.00
2705	LAKE MCDONALD	5/28/2013	2	7:00	16:00	9.00	18.00
2706	LAKE MCDONALD	6/4/2013	2	7:00	17:00	10.00	20.00
2707	LAKE MCDONALD	6/5/2013	1	7:00	17:00	10.00	10.00
2708	LAKE MCDONALD	6/14/2013	1	8:00	17:00	9.00	9.00
2828	LAKE MCDONALD	7/20/2013	12	12:00	16:00	4.00	48.00
2829	LAKE MCDONALD	7/20/2013	11	11:00	12:00	1.00	11.00
2824	LAKE MCDONALD	7/21/2013	1	12:00	20:20	8.33	8.33
2862	LAKE MCDONALD	8/9/2013	1	9:15	20:00	10.75	10.75
2841	LINCOLN	7/24/2013	1	8:00	18:30	10.50	10.50
2683	LOGGING	5/15/2013	1	7:00	11:00	4.00	4.00
2684	LOGGING	5/17/2013	1	6:30	12:00	5.50	5.50
2685	LOGGING	5/30/2013	2	7:30	17:30	10.00	20.00
2687	LOGGING	6/13/2013	3	7:00	17:00	10.00	30.00
2692	LOGGING	6/13/2013	3	12:00	16:30	4.50	13.50
2688	LOGGING	6/14/2013	3	7:00	15:30	8.50	25.50
2689	LOGGING	6/15/2013	3	7:00	15:30	8.50	25.50
2691	LOGGING	6/15/2013	3	7:00	15:30	8.50	25.50
2839	LOGGING	6/28/2013	1	13:00	19:00	6.00	6.00
2795	LOGGING	7/20/2013	1	7:30	20:00	12.50	12.50
2797	LOGGING	7/21/2013	1	8:00	13:00	5.00	5.00
2693	LOWER QUARTZ	5/26/2013	2	5:30	17:30	12.00	24.00
2694	LOWER QUARTZ	6/1/2013	1	5:45	17:15	11.50	11.50
2803	LOWER QUARTZ	7/20/2013	1	7:00	17:00	10.00	10.00
2695	LOWER SAINT MARY (OUTSIDE PARK)	5/20/2013	1	6:30	17:30	11.00	11.00
2782	LOWER SAINT MARY (OUTSIDE PARK)	7/20/2013	1	6:50	18:40	11.83	11.83
2889	LOWER SAINT MARY (OUTSIDE PARK)	9/13/2013	1	7:15	21:00	13.75	13.75
2898	LOWER SAINT MARY (OUTSIDE PARK)	9/20/2013	1	6:00	9:30	3.50	3.50
2903	LOWER SAINT MARY (OUTSIDE PARK)	9/20/2013	1	14:30	15:30	1.00	1.00
2696	LOWER TWO MEDICINE	5/18/2013	1	8:00	19:30	11.50	11.50
2781	LOWER TWO MEDICINE	7/20/2013	1	6:50	18:40	11.83	11.83
2880	LOWER TWO MEDICINE	8/26/2013	1	9:30	16:20	6.83	6.83
2709	MIDDLE QUARTZ	5/26/2013	2	5:30	17:30	12.00	24.00
2710	MIDDLE QUARTZ	6/1/2013	2	5:45	18:00	12.25	24.50
2804	MIDDLE QUARTZ	7/20/2013	1	9:00	19:00	10.00	10.00
2763	MOKOWANIS	6/17/2013	1	6:30	19:30	13.00	13.00
2840	MOKOWANIS	7/24/2013	1	8:15	17:30	9.25	9.25
2863	MOKOWANIS	8/6/2013	2	8:00	20:00	12.00	24.00
2864	MOKOWANIS	8/9/2013	1	18:30	20:35	2.08	2.08
2711	QUARTZ (UPPER)	5/27/2013	2	8:00	17:30	9.50	19.00
2712	QUARTZ (UPPER)	6/1/2013	2	5:45	18:00	12.25	24.50
2805	QUARTZ (UPPER)	7/20/2013	1	11:00	21:00	10.00	10.00

Common Loon Citizen Science
Volunteer Hours

Loon_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
2806	QUARTZ (UPPER)	7/21/2013	1	7:00	17:00	10.00	10.00
2713	RED EAGLE	5/18/2013	1	7:00	19:45	12.75	12.75
2780	RED EAGLE	7/20/2013	1	7:00	19:30	12.50	12.50
2879	RED EAGLE	8/25/2013	2	8:00	16:00	8.00	16.00
2714	RED ROCK	6/1/2013	1	6:30	18:30	12.00	12.00
2775	RED ROCK	6/27/2013	1	14:00	18:00	4.00	4.00
2764	RED ROCK	7/7/2013	1	12:00	16:00	4.00	4.00
2811	RED ROCK	7/21/2013	1	6:30	21:45	15.25	15.25
2865	RED ROCK	8/8/2013	1	8:45	19:00	10.25	10.25
2715	ROGERS	6/12/2013	4	7:30	18:30	11.00	44.00
2814	ROGERS	7/20/2013	1	8:15	18:30	10.25	10.25
2894	ROGERS	9/17/2013	3	7:00	17:00	10.00	30.00
2719	SAINT MARY	6/28/2013	1	7:00	15:00	8.00	8.00
2765	SAINT MARY	7/8/2013	1	12:00	16:00	4.00	4.00
2848	SAINT MARY	7/17/2013	1	7:00	17:00	10.00	10.00
2783	SAINT MARY	7/20/2013	1	6:50	18:40	11.83	11.83
2866	SAINT MARY	8/8/2013	1	8:45	19:00	10.25	10.25
2716	SHERBURNE	6/11/2013	4	7:00	18:00	11.00	44.00
2752	SHERBURNE	6/16/2013	1	9:00	11:00	2.00	2.00
2766	SHERBURNE	7/8/2013	1	7:00	12:00	5.00	5.00
2809	SHERBURNE	7/21/2013	1	6:30	21:45	15.25	15.25
2902	SHERBURNE	9/21/2013	1	14:00	16:00	2.00	2.00
2724	STUMP	5/15/2013	1	7:30	19:00	11.50	11.50
2720	SWIFTCURRENT	5/6/2013	1	9:40	15:00	5.33	5.33
2721	SWIFTCURRENT	5/13/2013	1	6:30	14:00	7.50	7.50
2722	SWIFTCURRENT	5/15/2013	1	7:30	19:00	11.50	11.50
2725	SWIFTCURRENT	5/20/2013	1	6:30	17:30	11.00	11.00
2726	SWIFTCURRENT	6/1/2013	1	6:30	18:30	12.00	12.00
2727	SWIFTCURRENT	6/11/2013	4	11:15	13:15	2.00	8.00
2728	SWIFTCURRENT	6/14/2013	1	11:30	11:35	0.08	0.08
2729	SWIFTCURRENT	6/26/2013	1	7:30	18:00	10.50	10.50
2776	SWIFTCURRENT	6/28/2013	1	12:00	16:00	4.00	4.00
2818	SWIFTCURRENT	7/20/2013	1	5:00	18:30	13.50	13.50
2867	SWIFTCURRENT	8/8/2013	1	8:45	19:00	10.25	10.25
2731	TROUT	6/5/2013	2	11:00	21:00	10.00	20.00
2732	TROUT	6/9/2013	1	11:30	18:00	6.50	6.50
2733	TROUT	6/11/2013	1	9:45	17:30	7.75	7.75
2777	TROUT	7/12/2013	1	8:00	17:30	9.50	9.50
2813	TROUT	7/20/2013	1	8:15	18:30	10.25	10.25
2895	TROUT	9/17/2013	3	7:00	17:00	10.00	30.00
2734	TWO MEDICINE	5/18/2013	1	8:00	19:30	11.50	11.50
2735	TWO MEDICINE	5/18/2013	2	10:30	17:30	7.00	14.00

Common Loon Citizen Science
Volunteer Hours

Loon_Survey_Key	Site Name	Survey_Date	Num_Observers	Start of Day	End of Day	Day Hours	Total Hours
2736	TWO MEDICINE	6/17/2013	1	19:30	21:00	1.50	1.50
2789	TWO MEDICINE	7/20/2013	1	7:00	19:00	12.00	12.00
2881	TWO MEDICINE	8/26/2013	1	9:30	16:20	6.83	6.83
2778	UPPER KINTLA	7/9/2013	1	7:00	19:00	12.00	12.00
2801	UPPER KINTLA	7/21/2013	1	5:00	21:10	16.17	16.17
2877	UPPER KINTLA	8/24/2013	1	7:50	18:30	10.67	10.67
2900	UPPER KINTLA	9/19/2013	2	11:30	16:00	4.50	9.00
2779	UPPER TWO MEDICINE	7/14/2013	1	11:30	19:15	7.75	7.75
2843	UPPER TWO MEDICINE	7/17/2013	1	15:45	16:00	0.25	0.25
2788	UPPER TWO MEDICINE	7/20/2013	1	7:00	19:00	12.00	12.00
2882	UPPER TWO MEDICINE	8/26/2013	1	9:30	16:20	6.83	6.83
2755	WATERTON	7/2/2013	2	6:00	22:00	16.00	32.00
2793	WATERTON	7/21/2013	2	19:30	21:30	2.00	4.00
2874	WATERTON	8/24/2013	2	10:00	18:30	8.50	17.00
2875	WATERTON	8/24/2013	2	10:00	18:30	8.50	17.00
2896	WATERTON	9/19/2013	1	16:45	18:15	1.50	1.50
2737	WINONA/MUD	5/2/2013	1	9:00	15:00	6.00	6.00
2738	WINONA/MUD	5/17/2013	1	12:00	21:00	9.00	9.00
2739	WINONA/MUD	5/24/2013	1	7:45	16:00	8.25	8.25
2740	WINONA/MUD	5/30/2013	2	7:30	17:30	10.00	20.00
2741	WINONA/MUD	6/1/2013	2	13:34	14:45	1.18	2.37
2742	WINONA/MUD	6/11/2013	1	6:50	17:00	10.17	10.17
2756	WINONA/MUD	7/7/2013	1	11:00	20:00	9.00	9.00
2830	WINONA/MUD	7/19/2013	12	8:30	13:00	4.50	54.00
2831	WINONA/MUD	7/19/2013	11	8:30	13:00	4.50	49.50
2821	WINONA/MUD	7/20/2013	1	11:00	19:30	8.50	8.50
2787	WINONA/MUD	7/21/2013	1	7:00	19:00	12.00	12.00
2870	WINONA/MUD	8/18/2013	2	12:45	14:00	1.25	2.50
							3003.17

Elizabeth Flesch
Internship Summary
2013 High Country Citizen Science Project

Rocks crunch and damp thimbleberry leaves brush my arms as I accelerate up the trail along a rock face. I pause to catch my breath, taking a moment to glance down below at Gunsight Lake, a deep blue jewel nestled among magnificent mountains. To my left, ghostly white figures saunter across a sloped patch of vibrant green. I yank a pair of binoculars to my face, adjust the blurred image with a slight turn of the dial, and three mountain goats come into focus. I quickly set up my scope and tripod to begin a mountain goat survey at the Gunsight Pass survey site. Alas, just as I hunch over the scope and place my eye up to the lens, the three mountain goats I had previously spotted move out of view.



I am conducting this survey as part of Glacier National Park's Citizen Science Program, which uses trained volunteers to conduct surveys on wildlife species and invasive plants. This summer, I have had the privilege of serving as the coordinator of the High Country Citizen Science Project (HCCS), one of three projects run under the Citizen Science Program. The goal of the HCCS project is to utilize volunteers to monitor Glacier's mountain goats, bighorn sheep, and pikas. My position has allowed me to conduct research on these alpine species, coordinate and train citizen scientists, and analyze data. In addition, it has given me a unique opportunity to learn first-hand how using trained volunteers can assist in building scientific insight and environmental awareness.

The fact is, alpine animals are difficult to observe (even when we know they are present) and, as I know after hiking many miles in Glacier's high country, collecting biological data in the mountains is often difficult, not to mention time consuming. I now realize the tremendous power of citizen science. While I spend seven hours hiking 17 miles and completing one survey, a trained volunteer could conduct another survey on the other side of the park. Or, on a good day, several surveys might be



conducted in various locations throughout Glacier. As an aspiring wildlife biologist, I realize the value and practicality of using citizen scientists and hope to continue to involve citizen scientists in wildlife projects throughout my future career.

Beyond being practical, working with citizen scientists is fun! I have tremendously enjoyed helping volunteers of all ages spot a bighorn sheep and identify pika sign among talus. I believe



by training others about these species and how to observe them, we not only gain more data, but also foster a sense of stewardship and appreciation of the natural world. As our society works to address issues that may threaten these high country species, a little more information and a few more informed people might make a significant difference.

Taylor Hanson
Internship Summary
2013 Common Loon Citizen Science Project



I'm Taylor Hanson and for the summer of 2013 I worked as the Common Loon Coordinator for Glacier National Park. I am a student at the University of Montana studying wildlife biology and minoring in nonprofit administration. I volunteered at a nature center in high school and came to love teaching people about wildlife and the natural world. In college I have worked on several projects related to reptiles in the Southwest.

I wanted to expand my experiences this summer by working in a different region of the country and working on different species. This position allowed me to experience working for a government agency and working on a new species, while expanding my experience coordinating volunteers. The volunteers were some of the best people I have worked with and I am glad I got to know them. I learned and put into practice new field techniques for both the common loon and high country research during my work this summer. As well, I got the experience of organizing research across a large part of the Montana common loon population. Being able to contribute to common loon research in Montana has been an incredible experience. These new skills will be invaluable in my future as a wildlife biologist.



Citizen Science VIP Hours
FY 2013

	Sum of Hours
2013	
Citizen Science	
Chinn, Robert E (Citizen Science)	226.5
Clothier, Susan	181.5
Fallon, Thomas	33
GYCP (Citizen Science)	654
Hanson, Taylor	538
Headley, Racheal	21
Hutchison, William	17
Jamerson, Khrystyne	45
Johnson, Brian G	191.25
Lundgren, Nancy	99
Murray, Matt	133
Newsom, Rebecca	36
Ouellet, Nicky	126
Peterson, Terry	36
Rosenkoetter, Travis M	16
Sierra Club - Ed Rothfuss	320
Steele, Gail	20
Steele, Theresa	101.25
Summer, Barbara (Citizen Science)	120
Williams, Becky R	20
Williams, Larry	20
Woods Project	216
Grand Total	3170.5

Citizen Science Program

2013 Publications, Metadata and Media Summary

Publications and Metadata

All professional publications (journal articles and theses), active datasets and published reports related to Glacier National Park's Citizen Science Program are catalogued in the National Park Service's Integration of Resource Management Applications (IRMA) web portal for data and information on park-related resources. "Citizen Science Metadata in IRMA" in this report includes titles of each product, display citations, reference codes and accessibility.

New publications written this year include a popular magazine article called "Counting Glacier's Mountain Goats", by Jami Belt, in the Fall 2013 issue of Fair Chase magazine, and an article written for the 2013 Crown of the Continent Research Learning Center newsletter about potential climate change impacts on mountain goats. Three resource bulletins related to the citizen science program were finalized or revised this year, including one on common loons, one on mountain goats and one on pikas and climate change.

Media

The citizen science program received a very large amount of media attention in 2013. The program was featured on the radio with an interview on KGEZ and 3 stories on Montana Public Radio including a story on the citizen science program as a whole and how volunteers can get involved, a story on loon ecology and citizen science loon monitoring, and a story on Montana Conservation Corps in which their engagement in our citizen science program was highlighted. We will be featured in a Montana PBS News Hour documentary on climate change developed by student from Sentinel High School (Missoula, MT) which will be completed in the spring on 2014, with film interviews with Program Coordinator, Jami Belt and students from the Flathead High School International Baccalaureate Class (Kalispell, MT) about our research on species that may be impacted by climate change. The citizen science program was featured in newspaper articles in the Great Falls Tribune, Hungry Horse News, Flathead Beacon, Daily Interlake, and the Missoulian. The program was also featured in on-line articles, including an article in the Earth Island Journal about conducting pika surveys to track their response to climate change, and in an article about citizen science opportunities in the National Parks Traveler. Finally, the program was mentioned in a podcast about the Glacier Youth Conservation Partnership that is posted on YouTube.

Citizen Science Metadata in IRMA

Reference Code	Type	Display Citation	Title	File Count	Visibility	Lifecycle	Date Of Issue
643976	Published Report	Belt J. 2006. Citizen Science for common loons in Glacier National Park. Glacier National Park Crown of the Continent Research Learning Center. West Glacier, Montana. Published Report-643976.	Citizen Science for common loons in Glacier National Park	0	Public	Active	2006/12/01
2188107	Journal Article	Moyer-Horner L and Others. 2012. Citizen Science and Observer Variability During American Pika Surveys. The Journal of Wildlife Management. 76(7)Journal Article-2188107.	Citizen Science and Observer Variability During American Pika Surveys	0	Public	Active	
2189033	Thesis	Belt JJ. 2010. Evaluating Population Estimates of Mountain Goats Based on Citizen Science. Thesis-2189033.	Evaluating Population Estimates of Mountain Goats Based on Citizen Science	0	Public	Active	2010/05/01
2192698	Published Report	Jeffress M and Others. 2013. Pilot testing a pika monitoring protocol in Glacier National Park: Project Report 2012. Natural Resource Technical Report. NPS/UCBN/NRTR—2013/667. National Park Service. Fort Collins, Colorado. Published Report-2192698.	Pilot testing a pika monitoring protocol in Glacier National Park: Project Report 2012	1	Public	Active	2013/01/01
2194764	Tabular Dataset	Belt J. 2013. Common Loon Citizen Science Monitoring in Glacier National Park. Tabular Dataset-2194764.	Common Loon Citizen Science Monitoring in Glacier National Park	0	Public	Active	2013/01/01
2195984	Journal Article	Belt JJ and Krausman PR. 2012. Evaluating population estimates of mountain goats based on citizen science. Wildlife Society Bulletin. 36(2):264-276. Journal Article-2195984.	Evaluating population estimates of mountain goats based on citizen science	1	Public	Active	
2201682	Journal Article	Carolin T and Others. 2011. Citizen scientists in action: Providing baseline data for climate-sensitive species. Park Science. 28(1):66–68. Journal Article-2201682.	Citizen scientists in action: Providing baseline data for climate-sensitive species	2	Public	Active	

Common Loon Citizen Science at Glacier National Park. Carolin T. 2006. Carolin T. Project-2204354.
Project

Reference Code: 2204354
Reference Status as of 11/13/2013: Active
Visibility: Public

Core Information

Project

Project Title	Common Loon Citizen Science at Glacier National Park
Project Brief Description	Employ trained volunteers to systematically monitor common loons occupying lakes within Glacier NP.
Project Begin Date	2006
Project End Date	-
Project Full Description	This program was created in 2006 to address the need for research on Common Loons, a priority species due to their vulnerability to climate change impacts. Primary goals are to establish baseline data on to monitor long-term loon population status, to detect changes in distribution, long-term trends, and climate change impacts.
Project Code	-
Project Notes	-
Lead	Jami Belt; Crown of the Continent Research Learning Center (NPS)
Sponsor	Tara Carolin

Holdings

Add Holdings

Holdings Have Not Been Identified

Information Resource Evaluation

Sensitivity	*Non-Sensitive* - The Information Resource does not contain any sensitive information.
Proprietary/Copyrights	*Non-Proprietary* - No copyrights or other ownership issues. There are no distribution restrictions based solely on the proprietary evaluation
Quality	*Medium* - The Information Resource is missing some information, but not information that is essential to the correct interpretation. There may have been some internal review of the Information Resource, but not a formal peer-review. The information may be unpublished, but has had some level of informal review.

Products

Manage Products

This Project Generated the following **4 Product(s)**

Grouped by Type

Journal Article: 1
Published Report: 1
Tabular Dataset: 1
Unpublished Report: 1

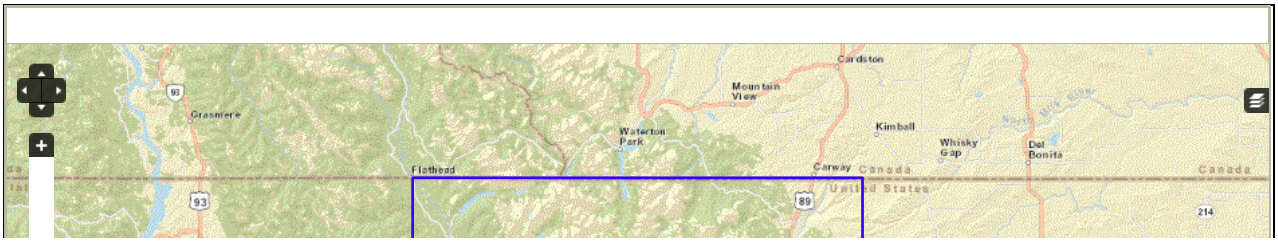
Grouped by Unit

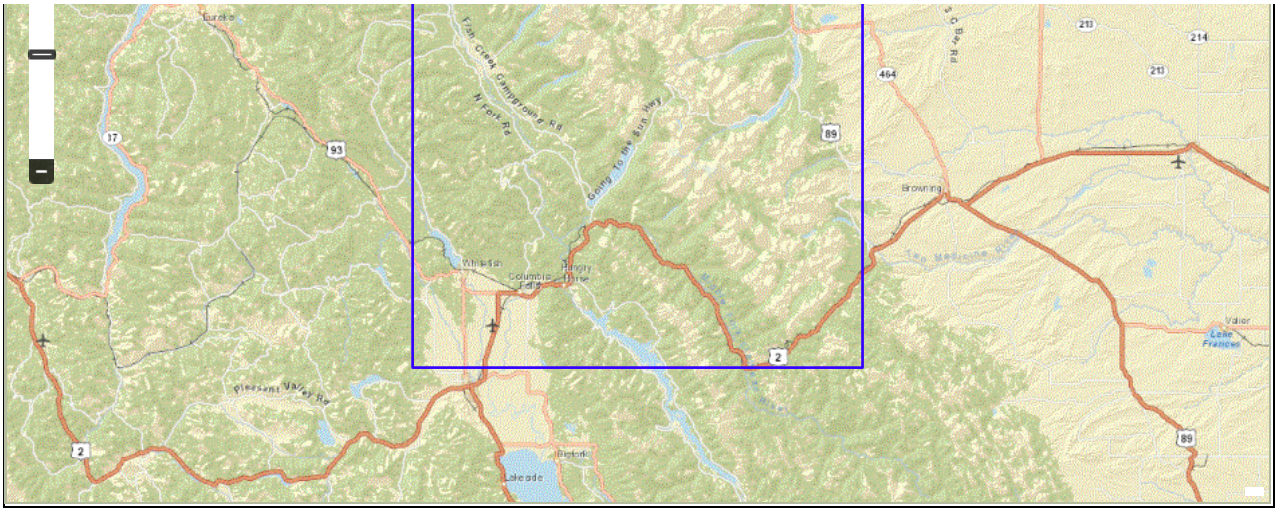
Glacier National Park (GLAC): 4

Unit Links and Geospatial Attributes

Unit Links: Glacier National Park (GLAC) - Approved

Bounding Boxes: Glacier National Park (GLAC). Default Bounding Rectangle: xmin, ymin: -114.4755, 48.23369 xmax, ymax: -113.242, 49.00097





Keywords

Subject Categories: Ecological Framework: Biological Integrity | Focal Species or Communities | Mammals

Biological Taxa: -

Freeform Keywords: citizen science, Monitoring, Common Loon, Gavia immer, Population Monitoring, trend monitoring, avian studies, Water Resources

Owners and Permissions

Owners: SWest@nps.gov, RMenicke@nps.gov, Logan@nps.gov, TCarolin@nps.gov, JBelt@nps.gov

Viewers: -

Version History

User Comments

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High Country Citizen Science at Glacier National Park. Carolin T. 2008. Carolin T. Project-2204353.
Project

Reference Code: 2204353
Reference Status as of 11/13/2013: Active
Visibility: Public

Core Information

Project

Project Title	High Country Citizen Science at Glacier National Park
Project Brief Description	Employ trained volunteers to systematically monitor focal species (mountain goats, bighorn sheep, pika) in the sub-alpine and alpine of Glacier NP.
Project Begin Date	2008
Project End Date	-
Project Full Description	This program was created in 2008 to address the need for research on mountain goats, bighorn sheep and pikas - priority species due to their vulnerability to climate change impacts. Primary goals for mountain goat and bighorn sheep monitoring are to establish baseline data on mountain goat population density and distribution, and to monitor long-term mountain goat and bighorn sheep population status, to detect changes in distribution, long-term trends, and climate change impacts. Primary goal for pika monitoring is to establish baseline data on distribution and persistence.
Project Code	-
Project Notes	-
Lead	Jami Belt; Crown of the Continent Research Learning Center (NPS)
Sponsor	Tara Carolin

Holdings

Add Holdings

Holdings Have Not Been Identified

Information Resource Evaluation

Sensitivity	*Non-Sensitive* - The Information Resource does not contain any sensitive information.
Proprietary/Copyrights	*Non-Proprietary* - No copyrights or other ownership issues. There are no distribution restrictions based solely on the proprietary evaluation
Quality	*Medium* - The Information Resource is missing some information, but not information that is essential to the correct interpretation. There may have been some internal review of the Information Resource, but not a formal peer-review. The information may be unpublished, but has had some level of informal review.

Products

Manage Products

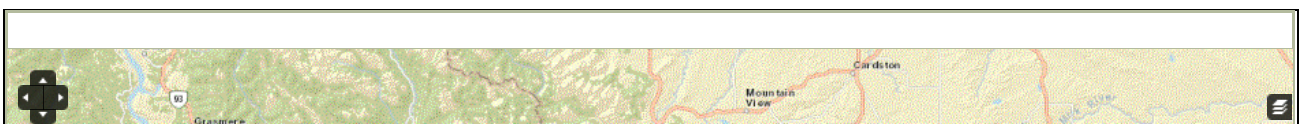
This Project Generated the following **6 Product(s)**

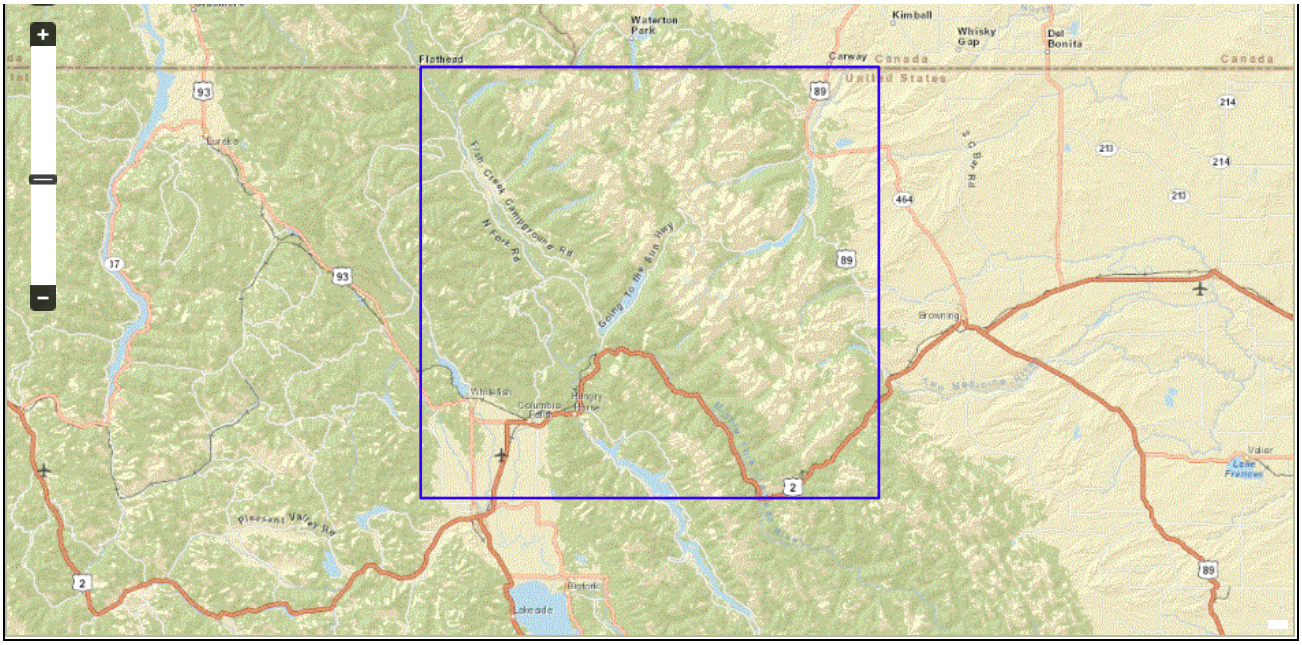
Grouped by Type
Dissertation: 1
Journal Article: 3
Thesis: 1
Unpublished Report: 1

Grouped by Unit
Glacier National Park (GLAC): 6
Natural Resource Stewardship and Science (NRSS): 1

Unit Links and Geospatial Attributes

Unit Links	Glacier National Park (GLAC) - Approved
Bounding Boxes	Glacier National Park (GLAC). Default Bounding Rectangle: xmin, ymin: -114.4755, 48.23369 xmax, ymax: -113.242, 49.00097





Keywords

Subject Categories: Ecological Framework: Biological Integrity | Focal Species or Communities | Mammals

Biological Taxa: -

Freeform Keywords: citizen science, Monitoring, Mountain Goat, Bighorn Sheep, pika, Population Monitoring, trend monitoring, alpine species

Owners and Permissions

Owners: SWest@nps.gov, RMenicke@nps.gov, Logan@nps.gov, TCarolin@nps.gov, JBelt@nps.gov

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Version History

User Comments

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Belt J and Carolin T. 2013. High Country Citizen Science Monitoring in Glacier National Park. Tabular Dataset-2204356.

Tabular Dataset

Reference Code: 2204356
Reference Status as of 11/13/2013: Active
Visibility: Public

Core Information

Tabular Dataset

Title	High Country Citizen Science Monitoring in Glacier National Park
Brief Description	Data on mountain goats and bighorn sheep is collected by citizen scientists and biological science technicians at 37 official survey locations throughout Glacier National Park as well as at unofficial sites. Data on pikas is collected at 25 mapped locations and at additional sites discovered by citizen scientists in the field. Incidental species seen during surveys are also recorded. This project was funded by the Glacier National Park Conservancy.
Date Issued / Released	November, 2013
Content Begin Date	May, 2008
Content End Date	-
Attributes / Field Names / ERD	-
Full Description	-
Purpose	This program was created in 2008 to address the need for research on mountain goats, bighorn sheep and pikas- priority species due to their vulnerability to climate change impacts. Primary goals for mountain goat and bighorn sheep monitoring are to establish baseline data on mountain goat population density and distribution, and to monitor long-term mountain goat and bighorn sheep population status, to detect changes in distribution, long-term trends, and climate change impacts. Primary goal for pika monitoring is to establish baseline data on pika distribution and persistence.
Notes	The database is in MS-Access format and continues to be developed with scientific information. Data collection is in progress, planned to continue in future years. Mountain goats have been monitored consistently at all sites since 2008. Bighorn sheep were added in 2013 and are monitored at all sites. Pika monitoring was conducted at all sites in 2008 to 2011. In 2012, the pika monitoring protocol associated with this dataset was replaced by an Inventory and Monitoring protocol developed by the Pikas in Peril program. Pika data from 2012- present represent sites monitored incidentally. Data QA/QC measures are in place but it should be noted that citizen science volunteers often omit data fields and have lower rates of detection than biological science technicians. Data are reviewed by citizen science coordinators and potential errors or omissions are addressed by contacting the data collector for clarification. Uncertain data is omitted. Data are entered by one biological science technician, reviewed by another technician, and then a random selection of 10-percent of all data are reviewed by the project lead. If frequent errors are detected at that stage, the entire dataset is reviewed.
Author	Jami Belt; Tara Carolin
Created By and/or For the NPS	This described Information Resource was created by and/or created for the National Park Service. All attached files will be archived by the Technical Information Center (NPS-TIC) and, where appropriate, the National Archives (NARA).

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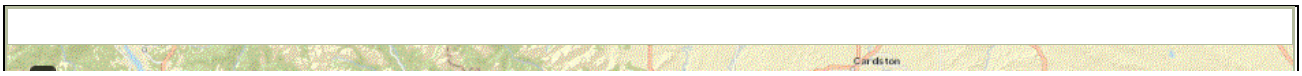
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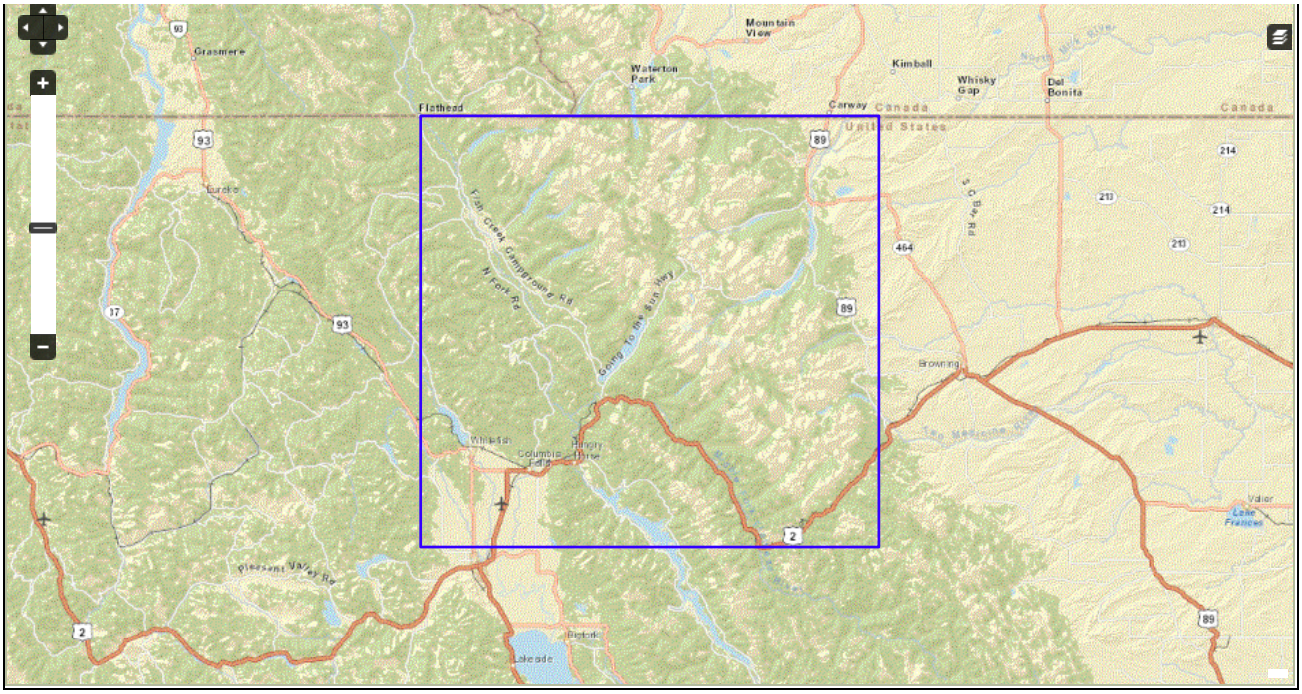
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Quality	*High* - The Information Resource is not known to be missing or contain misleading information AND adequate documentation on its generation is present. Generally, peer-reviewed materials (e.g., from published journal articles or rigorous monitoring programs) fall into this category.

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Freeform Keywords: mammal studies, citizen science, Population Monitoring, trend monitoring, alpine species, Mountain Goats, Oreamnos americanus, Bighorn Sheep (Ovis canadensis), American pikas, Ochotona princeps

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Common Loons *(Gavia immer)* Resource Brief

Background Information

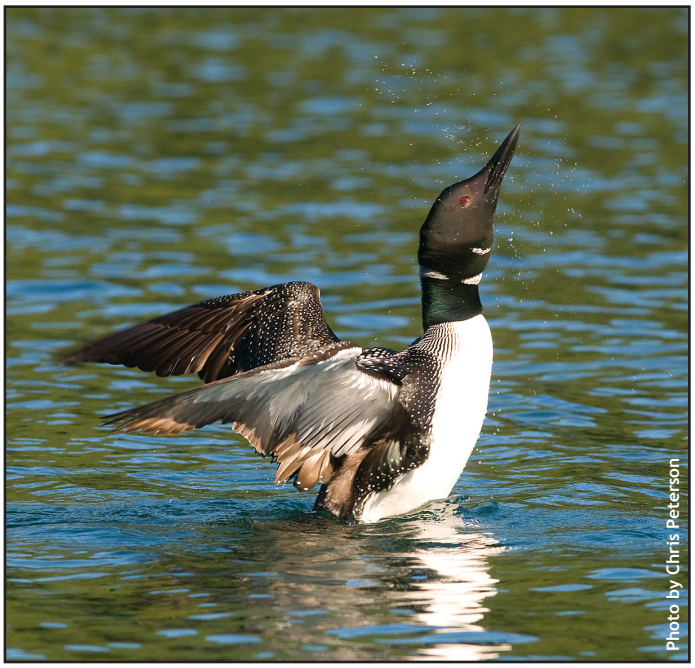
The common loon, with its mournful wail, conjures up images of wilderness, solitude, and remote northern lakes. They are found on pristine freshwater lakes throughout the Crown of the Continent Ecosystem during the breeding season (early spring through fall), migrating to coastal areas for the winter. Loons are large, relatively long-lived birds (living 25-30 years) that possess many unique adaptations, which allow them to be both excellent divers and swimmers. Unlike most birds, they have dense bones (rather than hollow), heavy bodies (8-12 lbs.), and comparatively small wings for their body size. These characteristics make loons adept at diving underwater in search of their main prey of fish. In addition, the loon's ability to quickly blow air out of its lungs and compress air out of its feathers gives it the ability to dive instantly when in search of food. A loon can also use these tactics to submerge its body below the water surface with only its head above water, making it less detectable.

Loons are also agile swimmers. Large, webbed feet and legs set far back on their bodies allow these birds to powerfully propel themselves underwater as well as in take off as they run on top of the water, flapping their wings in order to gain enough momentum for lift-off. These traits do, however, make it difficult for loons to walk on land and make take off virtually impossible if in a small body of water. They are only found on land when mating or nesting, or if sick or injured.

Status and Trends

Listed as a Species of Concern by the state of Montana, Montana's loon population is considered to be at risk and requires ongoing management in order to ensure population health. Besides threats from human activities, loons have a set of biological limitations that make them more vulnerable to change. Common loons have specific habitat requirements – requiring lakes over five acres in size, clear water, little disturbance, and a good supply of fish and/or aquatic invertebrates. They also have a low recruitment rate, only producing up to two chicks per mating pair each year, and are slow to mature (the average first year of successful breeding is seven years old).

Current estimates are that Glacier National Park (GNP)



Common loons have variety of calls and behavoirs that indicate something is disturbing them. This adult loon is reacting to a percieved threat by doing a penguin dance, a display used when the bird feels severely threatened.

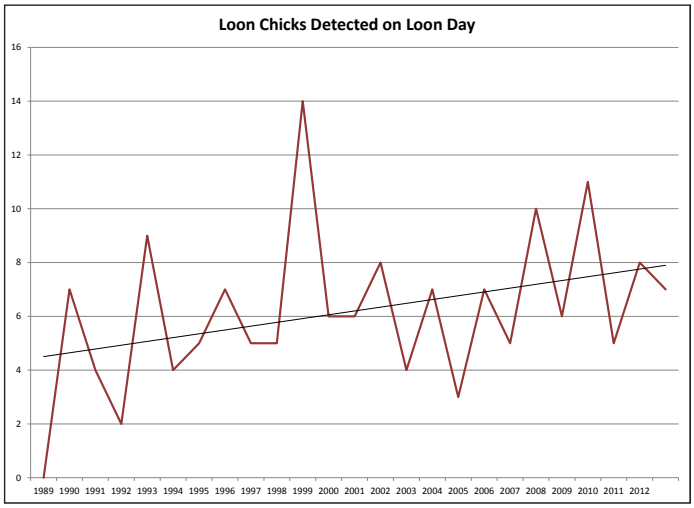
Threats

Once seen as far south as places like Colorado, Illinois, and northern California, habitat loss has confined the common loon's breeding habitat to far northern areas of the United States. Even in some of these areas, population numbers are in decline. In Montana, the common loon is listed as a Species of Concern and efforts are being made to monitor them throughout the state. The biggest threat to loons is human disturbance. Shoreline development, recreation and watercraft use, and human-caused water level fluctuations can lead to the loss of adequate nesting habitat or even the loss of nests and eggs themselves. Other threats include discarded fishing line, which can entangle and kill the birds, ingested lead from fishing lures, and mercury exposure, which can lead to reproductive failure and have possible effects on chick behavior and development.

harbors roughly 20% of the breeding population of common loons in the state of Montana. Yet, despite comprising such a large portion of the state's breeding loons, only 4-7 chicks are fledged each year. In order to better understand population trends and chick survival, GNP has participated in Montana Loon Day, an annual statewide common loon count that takes place in mid-July, since 1988. But, park managers realized to truly get an accurate count and to understand possible factors affecting nesting success, more consistent season-long monitoring was needed. To better track GNP's loon population, volunteer citizen scientists and park staff have been trained since 2005 to monitor 45 priority loon lakes at least three times throughout the breeding season. This season-long monitoring effort provides more accurate data and will help determine common loon population trends and factors affecting their survival. As of 2012, data from the last seven years of monitoring shows an average of 43 adult loons and 7 chicks in Glacier National Park.

Management Strategy

In 2005, park biologists and Crown of the Continent Research Learning Center staff created the Common Loon Citizen Science Project, which uses trained volunteers and staff to gather season-long data on common loons throughout Glacier National Park. The main goal of the project is to gain a better estimate of Glacier's loon population and to begin to identify factors affecting nesting success. Using a large volunteer workforce increases our coverage of all 45 of the park's priority loon lakes throughout the nesting season, thereby improving our accuracy of loon population counts, breeding pair numbers, and chick survival. The data collected helps determine possible threats to loon population health and allows park managers the information needed to make informed management decisions.



With more data collected each season, we see less variation in our estimate of loon chicks each year, and an overall increase in chicks counted. Although it's unclear if this increase is due to higher chick production or to better detection of chicks by trained citizen scientists, this graph shows less fluctuation in the number of loon chicks detected on Loon Day since 2005.

Resources For More Information

Glacier National Park Staff

- Jami Belt, Citizen Science Coordinator
- Lisa Bate, Wildlife Biological Science Technician

Documents and web sites

- The Birds of North America Online – http://bna.birds.cornell.edu/bna/species/313
- Montana Fish, Wildlife & Parks' Conservation Plan for the Common Loon http://fwp.mt.gov/fishAndWildlife/management/commonLoon/
- NatureServe Explorer: An Online Encyclopedia for Life – http://www.natureserve.org/explorer/
- Citizen Science for Common Loon Monitoring Education Presentation http://www.nps.gov/glac/naturescience/ccrlc-citizen-science_loons.htm

The Crown of the Continent Research Learning Center

Phone: 406-888-5827

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Websites: www.crownscience.org, http://www.nps.gov/glac/naturescience/ccrlc.htm

Crown of the Continent Research Learning Center

National Park Service
U.S. Department of Interior

Glacier National Park

Resource Bulletin

Climate Change and the Pika

A Cold Climate Rabbit

Glacier carved peaks, waterfalls, mountain goats, and grizzly bears all define the alpine country of Glacier National Park. What many people do not see are the smaller, less obvious members of this dramatic environment. Take the potato-sized, furry, North American pika (*Ochotona princeps*) for instance, found among talus slopes in Glacier National Park.

Princeps is a Latin version of the Chipewyan Indian name for pikas, translated to mean, "little chief hare." Pikas are in the lagomorpha order, related to rabbits, and have evolved to live in cool climates near the interface of talus slopes and meadows. A talus slope differs from a scree slope in that talus rocks are larger, up to 1 meter in diameter. Individual pikas defend home territories about 14 – 33 square meters. They define the perimeter by rubbing rocks with their cheeks, which contain apocrine glands, to scent mark the borders. In the center of their territory is often a large boulder. They use this conspicuous rock to survey for predators. If a coyote, pine marten, fox or a human arrives, pikas scream a shrill "eek!" to warn their kin of danger. If it is a long or short-tailed weasel, however, pikas remain silent, attempting to conceal their presence from their most efficient predator.

When not on the lookout, pikas take advantage of the short growing season of an alpine summer. They are generalized herbivores that also eat their caecal pellets, or protein-filled excretions typical of lagomorphs. Not only do pikas feed directly on plants and pellets, but they collect and store them as well. These storage caches, known as hay-piles, provide supplemental nutrients to help the pika survive the nine-month alpine winter.



Pika collect and store plants in "haypiles" to provide them sustenance through the nine-month alpine winter.

Pikas do not hibernate. They are actually excellent cold-climate survivalists. Their insulation and high metabolism keeps their body temperature at 104°F. These attributes benefit pikas in the winter, but are ineffective for rapid heat dissipation in warmer weather.

In fact, a pika begins to experience fatal stress levels when its body temperature reaches 109°F. In other words, just a 5°F increase in body temperature can cause a pika to die. Predicted warming may pose problems for pikas, especially if the areas they inhabit are experiencing consistently hotter summer days. A succcession of hot days may impact the ability of pikas to find cool, shady areas within the talus field, which they need in order to adequately regulate their body temperatures. Additionally, more time spent under the talus would limit the time spent above ground foraging for food.

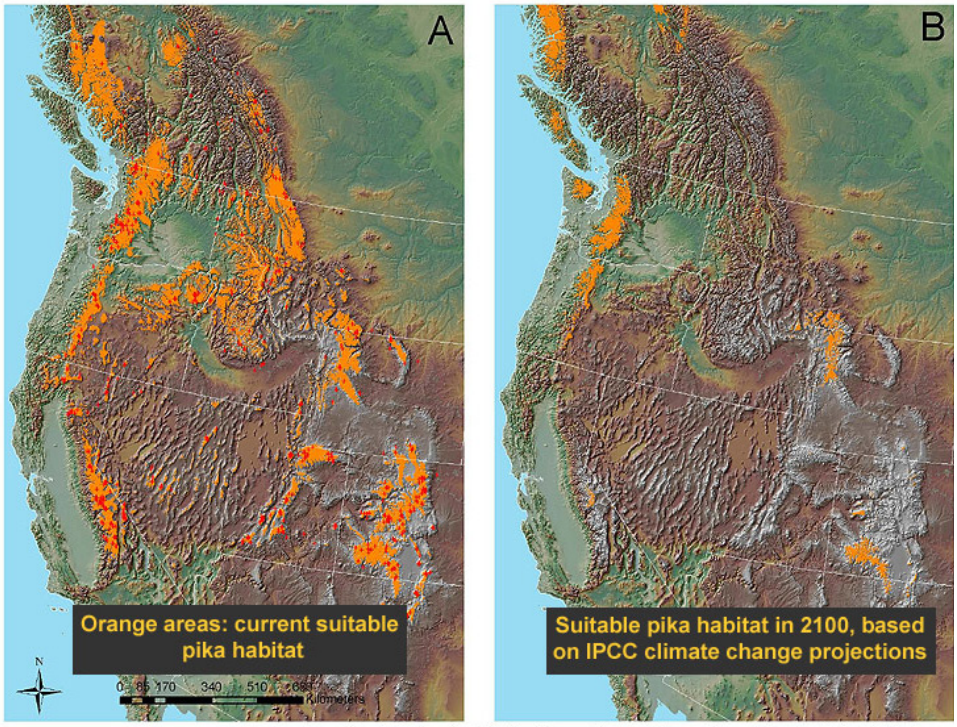
Impacts of a Changing Climate

Climatology models predict that the average temperature in North America will rise by 2 – 10 °F by the end of the 21st century. Glacier National Park has garnered climatology attention due to the

receding glaciers, but climate change may also have an impact on numerous species within the park...particularly alpine species like the pika.

Temperature is a crucial factor in determining pika habitat. In warmer climates, pikas live at higher elevations. In colder climates, they are able to live in lower elevations. In fact, fossil records indicate that pikas did not always live in the alpine. Prior to the Early Holocene Era, over 8,000 years ago, pikas lived in valley bottoms and grassland habitats in North America.

This long-term shift in habitat preference is important for understanding how the pika is likely to respond to global warming. Scientists in the Great Basin of Nevada found that 7 out of 25, or 28% of documented pika populations have gone extinct within the past 30 – 80 years. Evidence from the Great Basin shows that during the past 8,000 years, as the climate has generally warmed, pika populations have become extinct in lower elevations and have grown increasingly isolated on mountaintops. If the alpine warms at the predicted rates, even the mountain summits may not be cold enough to sustain pika populations.



Scott R. Loarie, PhD :: Carnegie Insitution :: Department of Global Ecology

Warming temperatures may also affect pika reproduction. Averaging only 2 – 3 offspring per litter, a pika's first (and most successful) of two litters, is conceived one month prior to the melting alpine snow pack. Timing is critical because it provides the lactating female pika with an abundance of food when she needs it the most. Earlier snow melt and unpredictable winter snow pack depths may disrupt natural timing, potentially leaving the offspring and mother susceptible to starvation.

Due to their vulnerability to high temperatures, increasingly isolated populations and low reproductive rates, scientists are concerned how climate change will affect the North American pika.

Glacier's Management Strategy

The effects of climate change on the pika in Glacier National Park are unknown. Therefore, in 2007, a University of Wisconsin PhD candidate, Lucas Moyer-Horner, began a three-year study monitoring pikas within the park.

Moyer-Horner and his research assistants identified 200 talus sites within the park suitable for pika habitat. Throughout the summers of 2008 and 2009, Lucas and his team monitored and collected data from these sites. This data will be used to develop a model to test the hypothesis that climate change increases the risk of pika extirpation. Over time, this will greatly improve our understanding of how pika distribution is affected by climate change.

Additionally, The Crown of the Continent Research Learning Center coordinates a citizen science program that monitors pikas. Citizen scientists are trained to monitor mountain goats and pikas throughout the park. The data collected will complement Moyer-Horner's study and establish a foundation for long-term monitoring of this charismatic creature of the alpine and its relation to a changing climate.


Cindy Cone Photo

Crown of the Continent Research Learning Center
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Resources For More Information

Glacier National Park Staff

Tara Carolin, Director, Crown of the Continent Research Learning Center

Jami Belt, High Country Citizen Science Program Coordinator

Documents and web sites

Broader History of Pikas
http://fwp.mt.gov/mtoutdoors/html/articles/portraits/pika.htm

Climate Change and Pikas
http://www.worldwildlife.org/species/finder/americanpika/item2835.html

The Millenium Ecosystem Assessment
http://www.millenniumassessment.org/en/index.aspx

Volunteer to monitor pikas with High Country Citizen Science. Contact Jami_Belt@nps.gov for more information.

Mountain Goats *(Oreamnos americanus)* Resource Brief

Background Information

One of Glacier National Park's iconic species, the mountain goat is only found in the northern latitudes of North America, and is more closely related to serows and chamois from Eurasia than to domestic goats. Today, some mountain goat populations found in the United States have been introduced, but those found in Glacier are native to the landscape. Mountain goats primarily inhabit alpine and subalpine environments and are often found traversing nearly vertical cliff edges. They are exceptional climbers, using their large, muscular forequarters to climb up rocky ledges and steep slopes of 60 degrees or more. Their hooves are also helpful in maneuvering this difficult terrain. Mountain goats have cloven hooves, or a hoof split into two toes, which spread out when needed. This stability along with flexible, soft inner pads allows the goats to grip the rock walls and cliffs they inhabit.

Summer months provide abundant food for mountain goats including a variety of alpine flowers, grasses, and sedges. During the long winter months, the mountain goat's diet is more sparse. Wintering high on steep cliffs above snow line or in areas where little snow accumulates, mountain goats find exposed vegetation not eaten during the summer as well as shrubs and lichens. Although often treacherous, these steep cliffs not only provide food for the goats, but also offer protection from predators.

Status and Trends

The health and continuity of mountain goats is one indicator of a healthy alpine ecosystem. At the center of the Crown of the Continent Ecosystem, Glacier National Park provides critical protection and preservation for species of concern. When periodic monitoring began to observe a decline in the number of goats visiting Glacier's Walton Goat Lick, park biologists became concerned that the overall mountain goat population in Glacier may be unstable. To gain a greater understanding of changes in that population, resource managers needed to gather baseline data on them — a difficult task, considering the significant amount of staff and resources needed to monitor a species that lives in such rugged terrain. In most areas, aerial surveys taken by helicopter are seen as the



Exceptional climbers, mountain goats are often seen on rocky, steep cliffs. However, goats also use dense timber and creek bottoms for security and protection against extreme heat, cold, and wind.

Threats

Mountain goats are commonly seen in Glacier National Park and it's estimated that the park has one of the largest populations of mountain goats in the lower 48 states. However, declining numbers in parts of the Crown of the Continent Ecosystem and pressures from climate change are causing concern for the health of this species. Like other alpine species, mountain goats are sensitive to habitat conditions. They rely on high, cool, rocky terrain for their survival. Glacier is currently experiencing warming three times the global average at higher elevations. It is uncertain how a warming climate will affect mountain goats, but the park is near the southern extent of the mountain goat's native range. Like any species at the edge of its range, Glacier's mountain goat population is likely to feel the effects of climate change earlier than populations further north.

ideal method for counting mountain goats, but helicopters can be particularly invasive to mountain goats, disturbing to visitors, and expensive. These factors spurred the creation of the High Country Citizen Science project (HCCS), which uses a volunteer workforce to conduct ground surveys to monitor mountain goat population abundance, distribution, and trend within Glacier National Park.

The HCCS program recruits citizen science volunteers and teaches them about mountain goat ecology, field identification, and classification of age and sex. Citizen scientists work in the field with HCCS staff, learning survey protocols and how to use survey equipment. Once trained, these volunteers choose from a list of survey locations throughout the park, based on their ability and preference, and conduct a one-hour observation.

Typically, population trends for wildlife species can take many years to determine. Mountain goats are no exception. However, using an occupancy model, HCCS program managers are developing a five-year trend graph (using data collected between 2008 and 2013) that shows the average number of goats per survey site and thus a total population estimate for mountain goats within the park. Resource managers hope to continue surveys into the future in order to detect any changes in the park's overall mountain goat population or distribution.

Management Strategy

Park managers and researchers are exploring the full potential of utilizing the HCCS program as well as exploring other avenues of annual monitoring. Research



Part of the citizen science mountain goat survey is to take a verification photo. The photo helps biologists identify sex, age, and number of goats.

on mountain goat/human interactions and impacts from climate change is also underway. The park is working with the University of Montana to test alternate, minimally invasive capture-and-collar methods to pursue the many unanswered questions about how mountain goats are affected by roads, adjacent trails, and people in relation to other factors that affect goat distribution. This information will then be incorporated into park planning documents, such as the Going-to-the-Sun Road Corridor Management Plan, in order minimize impacts to both mountain goats and visitors to the park. By obtaining baseline data, monitoring populations, and studying individual collared goats, park managers hope to ensure the long-term health of this rugged, high-country icon of Glacier.

Resources For More Information

Glacier National Park Staff

- Jami Belt, Citizen Science Coordinator
- Mark Biel, Natural Resources Program Manager

Documents and web sites

- Jami Belt. 2010. Evaluating Population Estimates of Mountain Goats Based on Citizen Science. etd.lib.umt.edu/theses/available/etd-01222011-134220
- Mountain Goat Study at Logan Pass – Talking Points
  contact Mark Biel for more information
- High Country Citizen Science Education Presentation
  http://www.nps.gov/glac/naturescience/ccrlc-citizen-science_hc.htm

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COUNTING GLACIER'S MOUNTAIN GOATS

WITH HELP FROM A SMALL ARMY OF VOLUNTEERS



by Jami Belt

Citizen Science coordinator for Glacier National Park's Crown of the Continent Research Learning Center

Photos courtesy of NPS

"What should we do with that when the lightning makes it over Gunsight Pass?" asked Brian, the volunteer helping me survey mountain goats in Glacier National Park. He was staring at the spotting scope tripod sticking out of my backpack. We were four miles up the trail, well above tree line, and the storm clouds were moving in fast. Less than five minutes into our survey, the wind was tearing the data sheets from our hands, and sheets of rain and graupel were blotting out many of the cliff faces.

What were we doing up there? And why would somebody volunteer for such arduous work? It is all for the purpose of understanding and conserving Glacier's mountain goats in a changing world.

Getting to Know Goats

Mountain goats are one of Glacier's most iconic species, but little is known about their status and distribution throughout the park. The last count, conducted over a small section of the park, wrapped up in the late 1970s. Since then, many regions with native mountain goat herds in Montana, Alberta, Washington, and Idaho have seen declines in their annual aerial counts. Because of these declines and the relatively slow reproductive rates of mountain goats, some management areas have responded by lowering harvest quotas. Other regions are looking into winter motorized recreation as a possible source of population stress.

How are goats doing in Glacier National Park? A snapshot count at a well-used mineral lick was down from 10 years earlier, prompting questions about the population as a whole. However, since Glacier's goats are not exposed to hunting and motorized winter recreation, it's possible that stressors relating to changes in their alpine environment may be at work. The mountain goat is a species of winter, well-adapted to blend into the white background of its rugged snowy mountaintops. Questions abound. How might populations fare in response to diminished snow pack? Can goats continue to evade predators if upward-creeping tree lines begin to surround their rocky outcrops? Will nannies be able to adjust the timing of birthing to take advantage of an earlier peak in seasonal forage?

If Glacier National Park wants to assess whether habitat changes are having effects at the population level, it must start with a population estimate. This is a challenging prospect. Aside from funding issues, helicopter surveys over Glacier's extensive goat range do not have public support. Surveys would have to be done from the ground. But that would require a small army, numbering well beyond the park's small staff. Glacier's biologists decided to build their army the modern way, by recruiting volunteers. They set their sights on the seemingly endless supply of park visitors who choose to hike the back-country world where mountain goats roam.

In 2008 Glacier National Park launched the High Country Citizen Science Program, recruiting and training volunteers to help park managers gather baseline information about selected alpine species that may be vulnerable to climate change impacts. More than 150 local residents, visitors, and students volunteer each year, providing the boots-on-the-ground needed to monitor wildlife in the million acres of Glacier National Park. Traversing the high-elevation trails, these volunteers count mountain goats at 36 survey sites across the park. The purpose is to develop annual population estimates that help scientists detect long-term changes in goat numbers. Braving the harsh conditions in mountain goat country, these volunteers have conducted more than 1,000 goat surveys thus far.

Enlisting these citizens in a mountain goat science project undoubtedly fosters stewardship and an awareness of the issues facing the park's wildlife. But would it provide a reliable population estimate? That is the question I set out to answer for my master's research at the University of Montana, under the supervision of Boone & Crockett Professor Paul Krausman. As the project biologist, I commenced a series of "double-observer" surveys using a random selection of our volunteers to measure the detection probability of our mountain goat counts. Detection probability, the percentage of goats detected compared to the actual number present on the mountainsides, is needed to develop a reliable population estimate. It was also the reason Brian and I had ventured up to Gunsight Pass on such a stormy day.

Ups and Downs of Goat Surveys

Heading into the mountains, we watched the menacing cumulus clouds building to the west of us. I pressed on anyway, determined not to let this become the fourth day in a row of being chased off the mountain by a thunderstorm. Brian and I set up our spotting scopes and started the clock on our hour-long sampling period. I came to my senses when three billies, moving faster than I have ever seen, ran from the open meadows to the narrow overhanging cliff bands on the opposite side of Gunsight Basin. Goats fleeing from the oncoming weather is a good sign that we should do the same, so down the trail we went at a human pace, descending the four miles to get below tree line and a safe location to face the deluge. Wringing out our soaked socks, we watched the clouds rise and dissipate, revealing a bluebird sky. Then back up we climbed, not without a bit of grumbling, to regain the 2,000-foot elevation of the survey site.

Brian and I pulled out new, dry data sheets and started again, our two scopes side-by-side but no words passing between us. For the double-observer method to correctly estimate the number of mountain goats that we were missing during our counts, the two



ENLISTING CITIZENS IN A MOUNTAIN GOAT SCIENCE PROJECT UNDOUBTEDLY FOSTERS STEWARDSHIP AND AN AWARENESS OF THE ISSUES FACING THE PARK'S WILDLIFE.

BUT WOULD IT PROVIDE A RELIABLE POPULATION ESTIMATE?

surveyors have to count goats simultaneously without influencing each other's results. So I stifled the urge to exclaim "Brian, there are those billies that had run for cover!" as I watched them slowly meandering their way back to the lush green forage, now eight of them in a widely spread cluster.

You would think that a stark white animal should be hard to miss. But finding the cryptic goats against the backdrops of shiny scree fields, dirty spring snowfields, and shadowy rock walls is like a treasure hunt without a map. Besides the eight males, I counted 14 goats in nursery groups of nannies with their clean white young-of-year and some scruffy yearlings, and five more scattered adults. Brian detected 18 of the 27 goats, a result in keeping with our findings that trained volunteers detect on average 65 percent of the mountain goats present compared to an average 80 percent detection rate by biologists. Not too bad for volunteers with highly varied skill levels.





Making Sense of Goat Numbers

Our estimate of detection rates by volunteers is a critical piece of the puzzle. Knowing how many goats are missed during each survey allows us to correct our density estimate of goats within the visible areas of our ground surveys. Interestingly, the percentage of goats seen by volunteers on the ground are a bit higher than rates reported for helicopter surveyors. This is encouraging because aerial surveys are the most commonly-used approach and considered the gold standard for goat monitoring. But it is not really surprising. Volunteers have more time to study the terrain than a helicopter cruising by a goat at over 50 miles per hour. On the other hand, aerial surveys can see almost all of the terrain in an area, while ground surveys can only see goats in terrain that is not blocked from view. We need to visit each survey site many times to account for those goats not present in the viewshed.

Gunsight Mountain was named in 1891 by George Bird Grinnell, a co-founder of the Boone & Crockett Club, to commemorate a hunting trip in search of mountain goats and bighorn sheep. This mountain is a stronghold for the bearded climbers. Yet during other surveys at this site, we have seen a huge variation in the number of goats counted, from a high of 36 to a low of zero. In fact we record a lot of zeros, during surveys where we know the goats are out there but may be just on the other side of the ridge. It turns out that in spite of having relatively small home ranges, goats move around a lot within their home turf and getting a good count is often a matter of being in the right place at the right time. It is not as exciting for volunteers when no goats are spotted. But each time a zero count is reported, we get a better understanding of how many goats we might be missing because they are not available to be counted during our one-hour survey. We use this insight about the percentage of surveys during which goats are visible, combined with counts of the largest number ever seen during a survey, to get an overall detection probability.

The Power of Citizen Science

Herein lies the power of citizen science. While volunteers may miss some of the goats, they can visit the survey sites far more frequently than biologists, often more than 12 times each year. Frequent surveys are a huge boon for a species like goats, which are relatively abundant but not always present to be counted on the days that you made the arduous trek into their habitat. By being there more often, volunteers can better capture the variability of counts at each site, and are more likely to be there on a day when the largest number of goats from each home range is visible at the survey site.

Often it is the impressive volume of data that makes citizen science work, and that makes the concept so attractive to researchers. Citizen science programs have emerged nationwide, monitoring species from whale sharks to ladybugs. The sky is the limit, as in the case of citizen science programs that

WE ARE LEARNING MORE THAN WE ANTICIPATED ABOUT MOUNTAIN GOAT DISTRIBUTION AND PREDATION AND ARE BUILDING UP A STRONG CONSTITUENCY OF INFORMED WILDLIFE STEWARDS.

MOST IMPORTANTLY, WE ARE GIVING HUNDREDS OF PEOPLE A REASON TO SIT STILL, SLOW DOWN AND JUST OBSERVE WILDLIFE, A TASK THAT, IN THE WORDS OF ONE OF OUR VOLUNTEERS, "IS ONE OF THE MOST POWERFUL FORMS OF THERAPY AROUND."

perform the time-consuming work of searching telescope images for new celestial bodies. These programs often use social media and crowd-sourcing to solicit observations from a huge number of people, giving participants from many different backgrounds a chance to contribute to research and to learn about the important and often tedious work of science.

Many National Parks and other agencies have started engaging volunteers to help monitor wildlife and plants on their lands. Glacier National Park's program also monitors common loons, American pikas, invasive plants, and migrating raptors. Since the program was established, we have trained over 700 participants and more than 300 high school and university students, who have contributed more than 25,000 hours of survey effort. Like much of the research conducted in national parks today, our program is funded by a partner organization, the Glacier National Park Conservancy. The relatively low cost of managing a large team of volunteers means that our program, like many citizen science efforts, can be conducted over a longer term than many traditional research projects that are limited to two or three years of funding. Monitoring species for many years enables us to begin looking for trends in wildlife populations that may be linked to climate-related habitat changes, or shifts in species distributions that occur over decades.

Citizen science is not a panacea, however, and cannot fully replace research conducted by biologists. The research questions that can be tackled using citizen science programs are often driven by what data collection methods volunteers can be expected to perform reliably. This inversion of the scientific method may not work for many programs with highly specific research objectives. But for programs with broader goals, citizen science can provide an ideal partnership.

Participants are volunteers after all. While we would love it if all of our mountain goat surveys were done when the goats are most active, it is hard to convince volunteers that they should hike the 12 miles in grizzly country in the wee hours so as to reach the survey site before first light. We have also discovered that many volunteers are not comfortable using topographical maps, thus limiting our ability to get precise locations of where goats are seen that could be used to inform us about habitat use. But the baseline population data we have obtained provides a vital jumping-off point for future research. Encouragingly, our estimate of 1.1 to 1.4 mountain goats per square kilometer matched the estimate obtained during helicopter surveys conducted over a portion of Glacier National Park. If the population dips by 30 percent over a decade (based on International Union of Conservation and Nature criteria for re-classifying mountain goats as vulnerable), we could detect it with the help of our small army of volunteers. In the meantime, we are learning more than we anticipated about mountain goat distribution and predation and are building up a strong constituency of informed wildlife stewards. Most importantly, we are giving hundreds of people a reason to sit still, slow down and just observe wildlife, a task that, in the words of one of our volunteers, "is one of the most powerful forms of therapy around." ■

Jami Belt is the Citizen Science coordinator for Glacier National Park's Crown of the Continent Research Learning Center, leading monitoring programs for common loons, mountain goats, pikas, and invasive plants. She is also the author of I*nvasive Plants of the Crown of the Continent Ecosystem*. She treks around the mountains surrounding Columbia Falls, Montana, with her family.



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Citizen Science Program

2013 Education and Outreach Summary

We conducted numerous educational outreach programs, training the participants about the ecology and concerns of the wildlife and plant species we are monitoring, and engaging them in data collection. Approximately 278 individuals were educated during outreach presentations. We worked with 192 students and 34 teachers during outreach programs.

- Flathead High School International Baccalaureate class (65 in 3 classes in spring 2013, 20 in 2 classes in fall 2013)
- University of Illinois, Conservation Ecology Course (15)
- Glacier Youth Conservation Corps (Montana Conservation Corps) (41)
- Climate Change Teacher Workshop (19)
- Browning Middle School (11)
- University of Montana/ Flathead Lake Biological Station Ecology course (8)
- University of Montana Climate Change course (7)
- The Woods Project, (Chicago and Houston) (23)
- Sierra Club of Nevada (10)
- Master Naturalists (10)
- Flathead Valley Community College Adaptive Resource Management Course (9)
- Glacier Alumni Picnic (40)

High School and Middle School Groups

Flathead High School International Baccalaureate Class

In 2011, we initiated a curriculum-based program called Youth Exploring Science! (YES!), to engage high school and middle school students (underrepresented groups for education in park) in citizen science and implemented it at Flathead High School in Kalispell, Montana. To date we have worked with over 220 local high school students through this program. Each year students from two International Baccalaureate classes, Environmental Science and Systems (ESS) 1 and 2, explore the scientific method through the lens of our mountain goat and pika research. During classroom instruction and field trips students develop research questions, collect and analyze field data. We aim to empower students to put the scientific method into action to answer their own questions about the ecosystem.

In spring 2013, we completed the data analysis portion of the YES! program with 63 students from three classes (two sessions of ESS 1 and one session of ESS 2) who had begun the program in fall 2012, and worked with students to understand and write up the results from their hypothesis testing.

In fall of 2013, we worked with 18 new students from two classes during four classroom sessions at Flathead High School to teach students about mountain goat, bighorn sheep and pika ecology, climate change concerns. We helped students develop individual research questions and corresponding hypotheses, and devise methods to test their hypotheses using t-tests, a common statistical approach. The students from the first year class then came to Glacier for a two day field trip to conduct mountain goat/ bighorn sheep and pika surveys in Many Glacier. The students' experience was enriched by an overnight camping experience in the Many Glacier campground and by being joined during their field surveys by student reporters from Sentinel High School (Missoula) who were creating a climate change documentary for Montana PBS's News Hour. Students from the second year class also came to Glacier for a one-day field trip in Two Medicine with the intention of conducting mountain goat/ bighorn sheep and pika surveys,

but severe weather made it unsafe to travel to the field sites. Instead we practiced survey protocols and data collections by setting up mock pika plots in the Community Building and educated the students about wildlife handling and Glacier's mountain goat study at Logan Pass. We also set up a mock "CSI" lab to conduct a necropsy of a recovered common loon carcass and had students write up a findings report.

Browning Middle School

Browning Middle School's summer school program hosted a grant-funded summer experiential science curriculum program with field trips to the park focused on fire ecology, invasive plants and climate change. In June, we worked with 9 students, 1 science teacher and 1 Blackfeet language teacher from Browning Middle School teach them about our citizen science monitoring for species that may be impacted by climate change. We delivered a pre-field trip lesson to the science teacher to introduce the students to climate change and the potential impacts on mountain goats, bighorn sheep and pikas. Then we met the group in Many Glacier and hiked into the Red Rock Lake area to conduct a mountain goat and bighorn sheep survey and learn more about the species' ecology. The students spotted several groups of sheep and goats and learned how to document data and record their locations using GPS units and maps. We learned the Blackfeet words for bighorn sheep (Apohm'hkina) and mountain goat. At the survey site, the skies opened up, delivering a cold rain and chilly wind. Students stuck with the survey for about 15 minutes, writing on soggy data sheets, until the binoculars and spotting scopes were no longer able to be used. At the end, when we asked students to sum up their day in two words, several responded with "cold and awesome". The students developed research questions about goat and sheep as a post-field trip lesson the following day in their classroom and sent them to us. Several students wondered how the goat and sheep can avoid falling off the mountain in heavy winds.

The Woods Project

In July we partnered with the Glacier Institute to engage 18 students and 5 group leaders from the Woods project in our Common Loon Citizen Science project. The Woods Project is a program located in many locations throughout the US that seeks to develop leadership capacity and life skills in low income youth through a series of outdoor education/environmental awareness programs at wilderness sites in the United States. The students, ages 14- 18, from Chicago and Houston, were spending several days at the Glacier Institute to learn about the area before spending 5 days backpacking in the Bob Marshall Wilderness. They joined us for Summer Loon Days for their service project. We taught the students about loon ecology and monitoring and took them to Winona Lake to train them on survey methods. They were thrilled to get a chance to see 2 of the 8 loon chicks present this year in Glacier and to observe disturbance behavior as a bald eagle flew over and as another pair of loons arrived at the lake to engage in a territorial battle. Once trained, they headed out on their own to conduct surveys at Kintla, Bowman and McDonald Lakes to contribute to our summer loon day counts with multiple surveys at these large lakes. They posted their pictures on facebook and sent a thank you note, saying that they were grateful to have a chance to be a part of research. We anticipate this partnership to continue in future years.

<u>University students and youth interns</u>

University of Montana

Two classes from University of Montana joined the citizen science program again this year. The first, a summer Field Ecology course from the Flathead Lake Biological Station had 7 undergraduate students, 1 graduate students and 1 professor. The second, included 6 undergraduate students and 1 professor from a summer Climate Change field course. Both courses have been participating in out citizen science program since 2010. We trained students during the classroom portion of our High Country Citizen Science training session, alongside of other citizen scientists, and answered many questions about the role of citizen science in research now and in the future. Field Ecology students conducted goat and pika surveys at Numa Ridge Lookout after their training, while Climate Change students conducted surveys at Hidden Lake.

University of Illinois

We engaged students from University of Illinois in our citizen science program for the first time. The group of 13 natural resource undergraduate students from University of Illinois and 2 professors were participating in a summer Aquatic Ecology field course based out of Flathead Lake Biological Station. They came to Glacier to learn about fisheries here and to learn about other species dependent on aquatic ecosystems. They joined a Common Loon Citizen Science training session alongside other citizen scientists and then headed into the field to conduct spring loon surveys at Lake McDonald.

Flathead Valley Community College

In September, we partnered with Flathead Valley Community College's Adaptive Resource Management class, a component of the new Natural Resource Associate's degree offered by the college. Eight students and one professor from the class took our on-line Invasive Plants Citizen Science training before coming to the park. During their visit to the park, we reviewed the training, answered more general questions about invasive plant management and ecology and went into the field to find target invasive plant species. The students returned on 2 subsequent visits to conduct invasive plant surveys and to assist with hand pulling. This partnership is anticipated to continue in future years, and may be expanded to include more opportunities for Natural Resources students to volunteer in Glacier.

Glacier Youth Corps Partnership

The Glacier Youth Corps Partnership is a new volunteer partnership program supported by the Glacier National Park Conservancy, Montana Conservation Corps, National Park Foundation, and Glacier National Park. It provides diverse work and educational opportunities for youth ages 15-24 in Glacier National Park while supporting the completion of important park projects. Staff from the Glacier National Park Conservancy and Montana Conservation Corps wanted to expose crew members to citizen science to enrich and diversify their experience to include biology field work. In May we trained all 41 members of the 2013 crews at their Kalispell office on how to conduct surveys for our 3 citizen science projects. We hosted 2 GYPC crews for 5 days each and retrained them on survey protocols before sending them out to conduct surveys for the rest of the week. We also met with 3 additional crews who were heading into Glacier for facilities, fire and trail projects to do a one hour retraining prior to their hitch. These crews then conducted surveys while on location during the evening or afternoons. A total of 22 GYCP/ MCC crew members conducted citizen science surveys throughout the

park. Glacier National Park Citizen Science Program staff spent a total of 72 hours of training time.

Adult outreach groups and teacher workshops

Montana Master Naturalists Certification Program

The Master Naturalist program is a week-long course for adults "who want to stoke their curiosity and deepen their knowledge of the natural world" (from Montana Master Naturalists website). Participants are required to do volunteer service hours to maintain their certification. The program piloted a course based in Glacier National Park in partnership with the Glacier Institute. We delivered an outreach presentation to 10 participants on our citizen science program to participants and explained how they can get involved. Laura Law and I also met with course leaders to discuss partnerships with programs in Glacier that offer naturalist-focused volunteer opportunities.

Glacier National Park Climate Change Teacher's Workshop

Glacier National Park hosted a Climate Change teacher workshop in partnership with the Glacier Institute. We conducted an outreach presentation focused on climate change impacts to wildlife and curriculum-based citizen science education programs.

Glacier Alumni

Glacier's alumni employees meet each year for a picnic to reconnect with each other and the park. We were the featured speaker this year, and delivered an outreach presentation on our citizen science program. About 8 of the audience members were citizen scientists already and were happy to be able to learn more about our results and ask questions. Several other Glacier alumni expressed an interest in participating in future years.

Sierra Club

The Sierra Club of Nevada came to Glacier National Park for a service learning trip in August, working with Glacier's Citizen Science Program and Native Plant Nursery. We trained 10 participants during a High Country Citizen Science training session and then sent them out to conduct surveys during 3 additional days. In spite of seeing very few goats, sheep and pikas, the participants were delighted to be a part of the program, noting that they now understood that survey reports with no animals sighted equate to important data. One participant summed his experience up saying, "I mean, I would be hiking anyway in such a stunning place as Glacier National Park, but to get to do a hike and to be of service to science is almost more wonderful than I can wrap my mind around."

Youth Exploring Science (YES! to Science)
High School Citizen Science Program in Glacier National Park

Overview

Grade Level: 9-12

Subjects: Science, Math, Technology

Location: Glacier National Park mountain goat and pika survey sites

Skills: Observe, Categorize and Classify, Identify Relationships and Patterns, Communicate, Problem Solving, Use of Scientific Field Equipment

Concepts/Topics: Ecosystem diversity and health, interaction of living organisms with each other and their environment, environmental problems and people.

Vocabulary: Control, Data, Dependent Variable, Ecosystem, Error Analysis, Hypothesis, Independent Variable, Inquiry, Investigate, Natural Phenomenon, Observation, Prediction, Statistical Tests, Testable, Variable

Summary: Students will learn how to collect wildlife data, develop research questions and testable hypotheses, and calculate statistics using real collected data from Glacier's High Country Citizen Science Program.

Goal: Give students a hands-on approach to conducting the scientific method and understanding how conducting research can help answer pertinent questions for resource managers and wildlife conservation.

Objectives:

1) Tell what national parks protect and one reason why Glacier National Park was established.
2) Identify mountain goat and pika species in the field.
3) Provide two reasons that both mountain goats and pikas are studied due to concerns about effects of climate change in western Montana.
4) Collect data and analyze existing data to generate appropriate research questions to further the understanding of mountain goat/pika populations and resource needs.
5) Investigate climate change effects in Glacier National Park and understand the management issues this change may create for park managers.
6) Understand the scientific method and how to develop testable hypotheses.

Montana Curriculum Science, Math and Technology Standards addressed:

Science Content Standard 1- Students, through the inquiry process, demonstrate the ability to design, conduct, evaluate, and communicate the results and form reasonable conclusions of scientific investigations.

Science Content Standard 2- Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems.

Science Content Standard 3- Students, through the inquiry process, demonstrate knowledge of characteristics, structures and function of living things, the process and diversity of life, and how living organisms interact with each other and their environment.
Science Content Standard 5- Students, through the inquiry process, understand how scientific knowledge and technological developments impact communities, cultures and societies.

Technology Content Standard 1- A student must use digital tools and resources for problem solving and decision making.
Technology Content Standard 3- A student must apply digital tools and skills with creativity and innovation to express his/herself, construct knowledge and develop products and processes.
Technology Content Standard 4- A student must possess a functional understanding of technology concepts and operations.

Math Content Standard 1- Make sense of problems and persevere in solving them.
Math Content Standard 2- Reason abstractly and quantitatively.
Math Content Standard 4- Model with mathematics.
Math Content Standard 6- Attend to precision.

First Year Program

First Lesson:
1) Present "Introduction to the Citizen Science Program and Climate Change" PowerPoint presentation.
2) Within the presentation, make students aware of some climate change effects happening in Glacier National Park and why these changes caused concern for several "vulnerable" species, including mountain goats and pikas.
3) Allow time for questions.

Second Lesson:
1) Deliver presentation on mountain goat biology, identification, and reasons for studying them.
2) Explain mountain goat survey methods.

Third Lesson:
1) Deliver presentation on pika biology, identification, and reasons for studying them.
2) Explain pika survey methods.
3) Review survey sheets and identify variables currently collected. Define dependent vs. independent variables.
4) Assign students to develop three research questions for each species, using only the variables currently collected on the survey sheets, to be used during the last in-class lesson.

Fourth Lesson:
1) Ask the class to volunteer 3 or 4 examples of possible research questions they generated for both mountain goats and pikas. Use these examples to explain whether the question used the available research data and could be used to generate a testable hypothesis.
2) Break into groups of three and formulate a research question for each species. Develop a

corresponding hypothesis that is testable for each research question.
3) Gather students back together and ask students to share their research questions and hypotheses.
4) Ask students why scientists care about collecting data, asking questions, and developing hypotheses. What might their findings provide to resource managers?
5) Review upcoming field trip and necessary items to take.

Field Trip:
1) Teach students how to use GPS units and maps to navigate to mountain goat and/or pika survey sites.
2) Hike into field site(s).
3) Show students how to conduct surveys and record data, and how to use compasses, spotting scopes, binoculars.
4) Work with students on the use of digital cameras to take verification photos using digiscoping, taking digital photos through a spotting scope.
5) Ask students to follow survey protocols to conduct surveys to document mountain goat and pika populations.
6) Gather students back together to find out what they observed and discovered, what they would do differently in future surveys and solicit any questions or feedback.

Follow-up Classroom Lessons (1- 4 lessons depending on class needs)
1) Work with students to refine and finalize their research questions and corresponding hypotheses.
2) Explain how statistical tests are used to support or not support a hypothesis.
3) Work with students to isolate the variables needed for their hypothesis test, and to group and sort the data using Excel.
4) Conduct statistical tests using Excel software to determine significance values (P-values).
5) Help students understand their results.

Second Year Program

First Lesson:
1) Using the "Introduction to the Citizen Science and Climate Change Program" PowerPoint presentation, review climate change effects happening in Glacier National Park. Explain how those changes may affect wildlife species, notably more vulnerable species with specific habitat requirements such as mountain goats and pikas.
2) Allow time for questions.

Second Lesson:
1) Present presentation on mountain goat biology, identification, and reasons for studying them.
2) Explain mountain goat survey methods.

Third Lesson:
1) Present presentation on pika biology, identification, and reasons for studying them.
2) Explain pika survey methods.
3) Review survey sheets and identify variables currently collected. Define dependent vs. independent variables.

4) Have students identify research questions they would like to ask focusing on current predictions of how climate change might affect each of these species. What data could we use from the current collect data or what data could we get that would answer those questions.

Fourth Lesson:

1) Ask the class to volunteer 3 or 4 examples of possible research questions and predictions they generated for both mountain goats and pikas.
2) Break into groups of three and formulate a research question for each species. Develop a hypothesis focused on prediction of climate change impacts on mountain goats and pikas.
3) Gather students back together and ask students to share their research questions and hypotheses.
4) Ask students why scientists care about collecting data, asking questions, and developing hypotheses. What might their findings provide to resource managers?
5) Review upcoming field trip and necessary items to take.

Field Trip:

1) Teach students how to use GPS units and maps to navigate to mountain goat and/or pika survey sites.
2) Hike into field site(s).
3) Show students how to conduct surveys and record data, and how to use compasses, spotting scopes, binoculars.
4) Work with students on the use of digital cameras to take verification photos using digiscoping, taking digital photos through a spotting scope.
5) Ask students to follow survey protocols to conduct surveys to document mountain goat and pika populations.
6) Gather students back together to find out what they observed and discovered, what they would do differently in future surveys and solicit any questions or feedback.

Follow-up Classroom Lessons (1- 4 lessons depending on class needs)

1) Show examples using graphs and/or charts of relationships between some of the variables we are collecting data on (e.g. time of day and number of mountain goats seen, or elevation and number of pika haypiles detected).
2) Show examples of relationships between relationships between other wildlife and climate in the forms of graphs or charts.
3) Ask students to form groups and develop hypotheses related to how climate change might affect these relationships, building from the research questions developed in Lesson 4.
4) Work with students to refine and finalize their research questions and corresponding predictions/hypotheses.
5) Work with students to draw graphs of their predictions as a way to understand how to design research that can address these types of questions.

For more information about the YES! to Science program contact Jami Belt at 406-888-7986 or jami_belt@nps.gov. You can also find out more about the Citizen Science Program by visiting our website at http://www.nps.gov/glac/naturescience/ccrlc-citizen-science.htm.