Crown of the Continent
Research Learning Center

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Glacier National Park

Science in the Crown

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Bears, Berries, and Bees: The Implications of Changing Phenology

By Robina Moyer

A warm June day finds me perched on a steep slope, crawling through the brush in search of a small, metal disc attached to a huckleberry plant. This early in the season, the plants look spindly and fragile. Their leaves have just emerged and they are several weeks away from producing the dark-purple berries that are iconic to Montana. After several minutes, I locate the tagged plant. It clings to the soil, growing on the exposed, rocky mountainside.

I begin counting the small, green discs that will later turn into plump berries. When I look up, the shift in scale from a single branch to the entire valley catches me off-guard and I'm momentarily dizzy. Taken by itself, the huckleberry plant in front of me seems impossibly delicate, but my glance across the mountain reminds me of how tough these plants actually are. Along with the countless other huckleberry bushes on this slope, this plant is a critical and intrinsic part of the landscape.

I am out on the aptly named Huckleberry Lookout Trail with U.S. Geological Survey (USGS) Research Ecologist Tabitha Graves, who is interested in how these berries relate to another iconic Montana species—the grizzly bear. Her previous work focused on grizzly bears throughout North America, including in Glacier National Park, but her current project takes a less direct approach to bear research. Bears in Glacier and the surrounding area are primarily vegetarian, and it is estimated that huckleberries comprise up to 15% of their diet. But as Graves began her investigation on how huckleberry production might impact bear behavior, it became clear that very little is known about huckleberry ecology.

"We still don't have good predictive maps that tell us when, where, and how many huckleberries are out there," Graves explains as we hike up Huckleberry Mountain. This is

Continued on pg. 4

In This Issue

Cover Story 1
Director's Corner 2
Blackfeet Loon Ranger 3
Intern Spotlight 6
Welcome to the CCRLC 8

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Crown of the Continent
Research Learning Center

CCRLC is part of a network of research learning centers that the National Park Service established to promote research and scientific understanding.

www.crownscience.org

Director's Corner

By Tara Carolin

For the first time since 2007, representatives from the National Park Service (NPS) Research Learning Centers (RLCs) met face to face in Washington, D.C. last August. Our goal: finalize the Strategic Framework for NPS RLCs, which identifies the mission, vision, and goals of RLCs; and develop collaborative flagship projects to implement across all RLCs. Here are the results.

Mission. Research Learning Centers increase the effectiveness and communication of science in national parks.

Vision. Research Learning Centers envision a world in which national parks are living laboratories, tellers of science narratives, and exemplars of using science to manage resources and enrich visitor, local community, and employee experiences.

Strategic Goals

Promote national parks as premier places for scientific inquiry.
The Crown of the Continent Research Learning Center supports research through developing relationships with university, government agency, and other research partners. We assist researchers through the permitting process, provide access to lodging, and support research students by funding student fellowships.

Facilitate & promote the use of science to make resource management decisions.
RLCs identify data gaps and research needs, and seek funding and partnerships to conduct research that meets management objectives. We bridge land managers and decision makers with science information and connect research groups working on related topics.

Improve science literacy by incorporating science into visitor & staff experiences.
We promote science literacy through a variety of methods, such as engaging the public and students in meaningful scientific data collection and providing training and internship opportunities for youth. Brown bag presentations and our annual Waterton-Glacier Science & History Day connect the public and staff to scientists. Science communication products, such as videos, web pages, brochures, newsletters, and resource briefs divulge the latest research results (see crownscience.org).

Assess & evaluate RLC activities and adapt as necessary to achieve the vision.
Each year, we develop annual reports and review and evaluate our successes and accomplishments, along with areas of needed improvement. We have reached out to partners and our various audiences for feedback, and we expect to do more of this in the future to ensure our work is effective and beneficial.

Flagship Projects

Out of many potential worthwhile endeavors, RLC managers chose four flagship projects to collaborate on as a nationwide network.

1) Create a nationwide citizen science program to monitor changes in phe-

Continued on pg. 8

Loon Ranger to the Rescue

By Terry Peterson

The potholed, dirt road ahead of me does not make for a peaceful country drive, to say the least. But it does make for great scenery. As I follow the truck in front of me, trying to keep one tire on the "high side" and the other out of holes deep enough to engulf my vehicle's front end, I spot the most beautiful lake tucked into a sea of tall grass, waving in the wind for as far as the eye can see. Citizen science volunteer Susan Clothier and I are following Krissy Chief Moon to Mission Lake. The lake is located on the Blackfeet Reservation, which borders Glacier National Park, and Krissy is this year's Blackfeet Loon Ranger. We jostle along the rutted road in search of loons—common loons, which fly to Montana in the summer from the Pacific Coast to make their nests and raise their young.

Dog Gun Lake is one of 16 lakes on the Blackfeet Indian Reservation monitored for loons. In 2015, Blackfeet Loon Ranger Krissy Chief Moon surveyed 12 of the 16 lakes. *NPS photo.*

This marks the second year the Glacier Common Loon Citizen Science Project has mentored a loon ranger on the reservation. The agreement between the Blackfeet Community College and the Montana Loon Society allows for a Blackfeet college student to work for three months during the summer to conduct common loon surveys. This internship is part of a broader internship program, the Montana Loon Rangers, supported by the Montana Loon Society and the Common Loon Working Group, that hires interns to survey loons throughout Montana.

Krissy learned of this internship, funded by both the Montana Loon Society and Biodiversity Research Institute, while attending Blackfeet Community College in Browning. Immediately, she knew she was interested. Krissy was raised in traditional ways, as she says, "from a family of hunters," all fluent Blackfoot speakers. She helps her brother with his bird-hunting business on the Blood Reserve in Canada, and saw in this internship an exemplary out-of-doors experience to enhance her research skills.

For Krissy, the first research hurdle was to find each lake. Most of them have no signage. Following her to Mission Lake, I was told to turn at the cell phone tower at the top of the hill, get on the dirt road through the farm field, and drop into the lake basin. Luckily, Krissy's boyfriend had been to most of these lakes and was the best field guide Krissy could have found!

As I vigilantly negotiated the dirt road, I snuck a peek at the lake and noticed an array of shorebird species that I didn't know existed together in one spot (in Montana). Pelicans, geese, mergansers, grebes, curlews, plovers, gulls, coots, numerous mallards, and even a swan enjoyed the waters of Mission Lake. The three of us spent a number of hours scanning the lake shore. Although the variety of waterfowl was prolific, we saw no loons and little loon nesting habitat. This may have been because the lake gets a fair amount of use by both recreationists and cattle, and loons prefer more isolated spots. But among the campers, fisherman, boats, and cows, we did see interaction among many types of shorebirds, and had the pleasure of watching two coyotes endlessly chasing and playing on the hillsides as well as a fox running along the fence line, sniffing and searching for mice to eat. The three of us could have stayed for hours, but we gathered our gear and headed to our next survey site, Kipp Lake.

Following Krissy's truck closely, we successfully arrived at the lake. It looked like a smaller Mission Lake, with all the associated birds and similar amount of use, making it hard for loons to successfully nest. I was hop-

Continued on pg. 7

"Phenology" continued from pg. 1

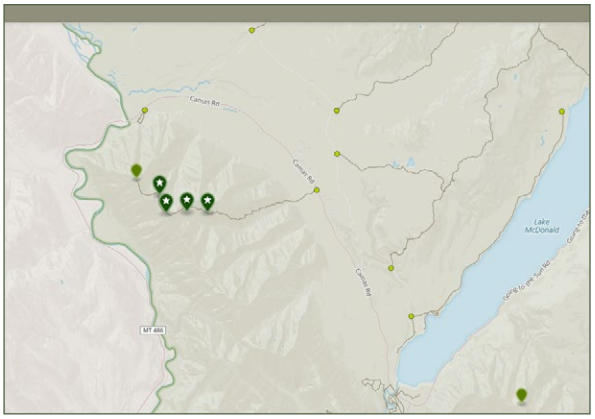
surprising, given their importance for both wildlife and people in Montana. Graves's current project aims to change that by looking at the productivity and phenology, or seasonal timing, of huckleberry plants. Phenology is not a new field of study. For millennia, people have documented seasonal events, such as bird migrations and crop harvests. But in recent years, phenology has gained more attention in North America, as a warming climate has led to noticeable shifts in phenological events.

Graves's goal is to develop a model that will combine phenology information with factors such as temperature, snow pack, rainfall, and elevation to predict berry production across a variety of spatial locations. Ideally, this model will help resource managers forecast berry production and be an important tool as climate change leads to shifts in the timing, location, and productivity of this vital food source for bears. Graves hopes managers will be able to use this information to anticipate and minimize bear-human conflicts.

Today, our goal is to check on four of the phenology plots, each consisting of ten plants. We will identify which phenological stage the tagged plants are in, replace temperature loggers, and check each site's remote camera. A camera is focused on a specific plant at each site, taking daily photos to document the plant's developmental progression between visits. The cameras ensure that important events, such as when the plant emerges from snow, are captured and recorded. This data will be combined with each site's elevation, slope aspect, and weather information to help Graves identify which factors are crucial to successful berry production.

As we make our way off-trail in search of the study plot, Graves discusses the other components of the project. In addition to phenology and productivity, she hopes to discover which bee species huckleberries rely on for pollination. It is currently unknown how many bee species pollinate the plants, if they are relatively rare or abundant, and how their life cycles match that of the huckleberry plant. To answer these questions, Graves has been netting bumblebees on huckleberry bushes and working with an entomologist to identify the captured species. Data from the first year of the project suggest that at least six bumblebee species are responsible for pollinating Glacier's huckleberry plants.

Graves has brought an insect net and specimen jars in case there is an opportunity to collect any bees.

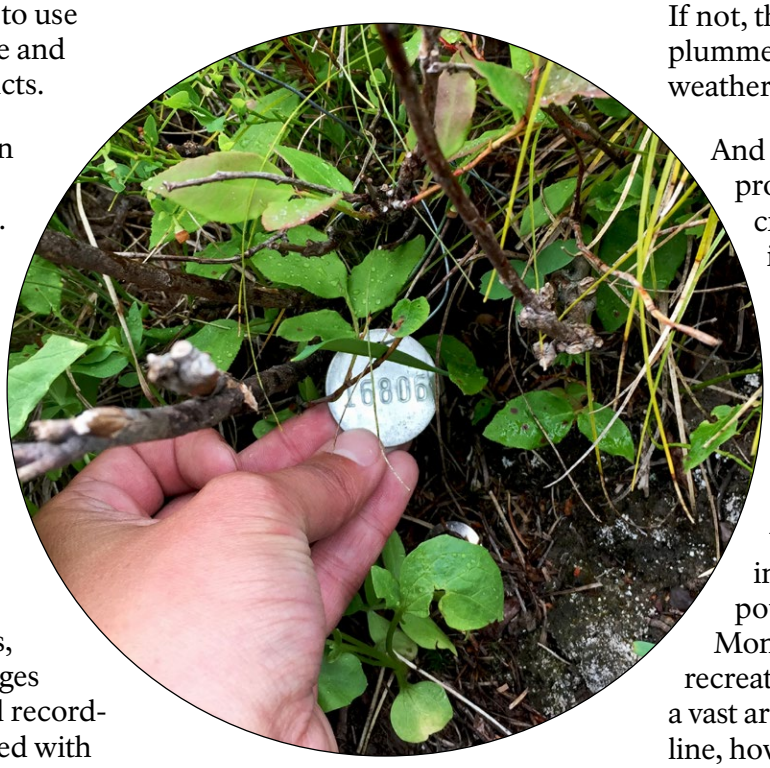


Dark-green markers show the phenology study plot locations found on Huckleberry Mountain.

Looking at the lineup of gear, I realize how much it takes to collect information on a simple plant. But then, what I've learned so far is that huckleberries are anything but simple.

Graves's enthusiasm for the project is infectious and I find myself thinking about the relationship between humans, huckleberries, bears, and bees in ways I have never before considered. If climate change causes the timing of the huckleberry's flowering to shift, will the bees needed to pollinate them be able to adapt? If not, then berry production could plummet—even with the right weather conditions.

And even if huckleberries remain productive, an earlier berry crop could affect a bear's ability to get sufficient calories in the fall, when it is trying to put on fat for the winter. In turn, bears may seek alternative food sources, possibly leading to increased conflicts with humans. Not to mention our love affair with huckleberries; changes in berry production have the potential to impact countless Montanans' commercial and recreational endeavors. With such a vast array of consequences on the line, how is it possible that so little is actually known about these plants?



Tagged huckleberry plant. *NPS photo.*

Many factors go into answering the deceptively simple question, "What are the right conditions for ideal huckleberry production?" Matters are further complicated by trying to collect baseline data when normal weather is no longer easy to define. Instead of seeing this as a problem, Graves embraces the challenge: "The kinds of conditions we're experiencing this year are more typical of what's anticipated in the future. We had a warm, dry spring. These conditions, along with increasing weather variability, are the kinds of things that have the potential to influence huckleberry productivity down the road." As we make our way through a dense thicket of huckleberries, a buzzing sound permeates the air. Bees—bumblebees! Graves quickly assembles the insect net while her assistant pulls out specimen jars. We all stalk the path for a few minutes, trying to pin point the bees' locations. After spotting a bee cupping the urn-shaped huckleberry flower, Graves swoops in with the net, securing the bee with a deft flick of her wrist. The bee is transferred from the net into a jar and will be taken back to the office to be identified. It is an unfortunate sacrifice of the project, but will provide invaluable information.

USGS researcher Tabitha Graves carefully contains a bumblebee caught in an insect net. The bumblebee will be transferred into a jar and taken to her office for identification. *NPS photo by Robina Moyer.*

Like so much in nature, the role of huckleberries is a complex one and the deficit of research is daunting. But after spending the day with Graves, it seems likely that many of these questions may soon be answered. Her passion and energy for the project are tireless and her easy-going demeanor allows her to take the challenges of a complex field project in stride. These qualities are contagious, even for someone who had never thought twice about the science behind a huckleberry.

Weeks later, I'm hiking in Glacier on a cool morning, traversing a trail high above Lake Ellen Wilson. The mountain peaks hold on tightly to a blanket of clouds, shrouding the valley in a gray fog. Just above the trail, a bush loaded with ripened huckleberries emerges from the mist. Suddenly, wherever I look, there are ripe berries, ready to be eaten. I pause to pick a few and savor their sweet, tart flavor.

Much further up the slope, a movement catches my eye and a black bear crosses toward a patch of huckleberries. I'm not the only one enjoying huckleberries this morning. For all their notoriety, it still amazes me that so little is known about these berries that are coveted by humans and bears alike. However, I feel confident that Graves's research will soon shed light on this treasure of the northern Rockies.

This article, along with audio podcasts and an interactive map of the study area, is also found on our website's "featured article" page.

Cover photo: Berries begin to ripen on a huckleberry plant. *USGS photo by Tabitha Graves.*

Intern Spotlight

By Laura Luther

An eerie call, a striking black and white spotted back, red eyes, and a prominent white "necklace" at the base of its neck are just a few of the characteristic features of the common loon—a bird species that far surpasses its simple name. I quickly discovered this as I began my internship as the coordinator for the common loon citizen science project at the Crown of the Continent Research Learning Center (CCRLC).

My job this past summer was to assist Glacier National Park's Citizen Science Program in coordinating and encouraging volunteers to collect observational data on factors that impact loon reproductive success. Engaging novice volunteers during loon trainings was an easy task. Thanks to the wealth of information and number of fascinating aspects of the loon's calls, behavior, and life cycle, the volunteers were hooked and ready to head to the field to observe this species of concern.

Throughout the summer, my internship drew me to the depths of the Northern Rockies' beautiful and rugged wilderness. The summer was characterized by little rain, but one of the few days of heavy precipitation occurred on my first field day. Despite the constant rainfall, we arrived in the northwest part of the park at Winona Lake, where we immediately observed two adult loons. Upon further investigation, we saw something on the back of one of the loons—a chick! Because chicks only have downy feathers at birth, they spend the first weeks of life frequently riding on a parent's back. This is rare to see, especially in Glacier, and later, I realized what a special sight this was.

Citizen Science Intern Laura Luther stands in front of Avalanche Lake in Glacier National Park. Luther assisted with a variety of research projects while working at the CCRLC, including surveying for harlequin ducks and monitoring whitebark pine plots. *Photo courtsey of Laura Luther*.

A few weeks later, I found myself up in the wee hours of the morning holding on tightly to an adult loon. Josh Martin, the CCRLC Citizen Science Coordinator, and I had the pleasure of aiding wildlife biologists from Montana Fish, Wildlife and Parks and the Biological Research Institute for a night of banding adult loons.

It was a unique experience to be able to scoop up a loon with a large fishing net from a small, motorized boat. In order to attract the loons to the boat, we played recorded calls of loon chicks. Netting and hauling them in was a feat because adult loons can weigh 8–12 pounds. Each adult loon was netted separately and taken to shore to be examined and banded. Samples of blood, fecal matter, and feathers were also collected. These samples help to determine the bird's health and in turn, the environment around them. Loons are a useful indicator for water quality because the presence of a healthy, reproducing loon population signifies clean, clear waters with intact shoreline vegetation. Analysis of the bird's health helps us to understand the surrounding ecosystem.

Although most of my focus was on loons, I also assisted with other resource management projects occurring in Glacier. Not only did I survey loons, but also mountain goats, bighorn sheep, and pikas, each of which are species monitored in the high country citizen science project. In addition, I gained experience with other biologists in the park. From working in the park's nursery to surveying streams for harlequin ducks, I was able to learn from many talented and hardworking biologists and volunteers. The camaraderie between field staff was remarkable to witness; everyone lends a helping hand and collaborates on data and observations.

Continued on pg. 7

"Loon Ranger" continued from pg. 3

ing we might see loons at these little lake gems, but it is unclear if lakes east of the continental divide, out on the edge of the prairie, ever had loons in the past. Also, accumstomed to seeing loons in Glacier's pristine backcountry lakes, I now had the realization that most lakes in Montana don't have the equivalent habitat and protections that I take for granted. Loons are not only easily disturbed, they are susceptible to lead poisoning, need clean, clear water to live in, and a substantial amount of fish to eat. Glacier has approximately 2.9% of the loon habitat in Montana and is home to 20% of the state's loon population. National parks provide a refuge for many wildlife species, fulfilling their needs for a population to endure over time.

Loons are only here during the nesting season, late April though September; then they migrate to the Pacific Ocean, where they winter in small inlets and bays from the Washington coast down to Baja. Common loons only produce one to two young a year, making each chick a large investment. Glacier's citizen scientists, Montana Loon Rangers, and this year, Krissy, monitor the reproductive success of common loons by collecting nesting data all over Montana. We'd like to have decades of data so we can see a trend; is the population going up or down?

Gathering data on the Blackfeet Reservation is in its infancy. This was the second year of the project and the first year most of the lakes were surveyed. But with Krissy's hard work, the 2015 season gave great insight to the status of lakes on the reservation. Krissy enthusiastically and meticulously surveyed twelve lakes. Babb Beaver Pond, a small lake along the entrance to Many Glacier but still within the reservation boundary, had one pair of loons that produced one chick. Goose Lake also harbored a pair of nesting loons, but the nest was abandoned mid-season. The rest of the lakes showed no loon sign and were often impacted by human use.

Although this isn't the best news for loons, I believe this program allows for a new beginning—an opportunity to inform people in the surrounding area about loons and their needs. We can't change the habitat, but we can educate the public about loons and their needs for survival. Loons are like the old adage, "the canary in the coal mine." The presence of a healthy, reproducing population of loons signals clean, clear waters with intact shoreline vegetation, a thriving fishery, and a safe migration route to wintering sites.

And, with folks like Krissy, the message is spreading. Krissy continues to be a beacon for the Blackfeet loon program. Although she is swamped with homework from her educational pursuits, she is giving presentations about loons at the Blackfeet Community College this fall, continuing to spread her enthusiasm for their conservation. This gives me hope that loons will find safe haven in other places beyond the park boundaries.

Krissy Chief Moon stops for a photo during one of her loon surveys last summer. *Photo courtsey of Krissy Chief Moon.*

"Intern" continued from pg. 6

Resident Loon Chicks Detected 2006–2015

2006: 5 chicks	2011: 8 chicks
2007: 10 chicks	2012: 6 chicks
2008: 7 chicks	2013: 8 chicks
2009: 11 chicks	2014: 12 chicks
2010: 5 chicks	2015: 6 chicks

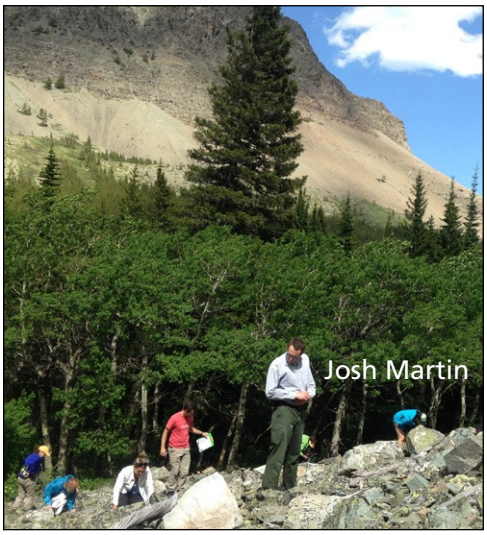
In four short months, this internship has enriched my observational field experience and given me the important skill of working with a team of researchers and volunteers. I have also enjoyed learning about the Crown of the Continent Ecosystem—its diverse vegetation and wildlife—and feel honored to have helped in preserving and protecting this special place.

What's next? I plan to gain further experience in the field of conservation and hope to return to Glacier for another loon summer before attending graduate school. And, of course, continue to explore the wilds of the Northern Rockies.

Welcome! New Staff Arrive at the CCRLC

By Melissa Sladek

Anya Helsel


Josh Martin

In 2015, two new staff members arrived at the Crown of the Continent Research Learning Center (CCRLC). Josh Martin started in May as the citizen science coordinator and Anya Helsel took over the management of Glacier's George C. Ruhle Library in August. Our previous research librarian, Sheree West, took a promotion and is now working for a public library in Washington state. Longtime Citizen Science Coordinator Jami Belt moved on to the wilds of Alaska, taking a position as the natural resource program manager at Klondike Gold Rush National Historical Park.

Martin hails from "all over," as he puts it, but mostly Colorado, where he studied Natural Resource Management and Watershed Science at Colorado State University. Prior to earning his degree, Martin served as an infantryman in the U.S. Army for four years. While in the army, he trained soliders in land navigation, first aid, and survival skills.

After working as a National Environmental Policy Act (NEPA) planner for the Pisgah National Forest in North Carolina for several years, Martin earned his MS degree in Environmental Science and Engineering from the Colorado School of Mines in 2013. Most recently, he worked at Zion National Park as a biological science technician for the park's vegetation program. Martin is excited to be a part of Glacier's Citizen Science Program and is currently on furlough, rejuvenating for next spring and summer's busy citizen science season.

Helsel came to the CCRLC from the Chicago area, where she was born and bred. She earned her Master's Degree in Library and Information Science in 2013. From 2008 until arriving in Glacier, Helsel worked at Professionals Library Service in Chicago. There she worked with a variety of law firms, aiding their research needs and managing their research libraries.

Helsel's love of national parks spurred her to leave the big city and head out West. The quiet of park headquarters and West Glacier are still somewhat of a shock, but Helsel is easily adapting to the scenic beauty of Glacier.

"Director's" continued from pg. 2

nology (seasonal stages of plants or animals) that can be adopted by and adapted to national parks anywhere in the country. Once the phenology program is established, additional nationwide citizen science projects may be developed for species such as weeds, butterflies, or birds.

2) Compile all fellowship opportunities offered by RLCs and create a unified call and website where students can search for opportunities.

3) Promote opportunities for science communication interns to assist RLCs with developing education and outreach products.

4) Develop a data bridge to provide scientists and students with access to national datasets via simple tools for visualizing and interpreting the data results.

Become a Featured Scientist

Each issue of "Science in the Crown" includes an article highlighting a different scientist or research project affiliated with Glacier, Grant-Kohrs Ranch, or Little Bighorn Battlefield.

These articles are intended to help make current park science more visible and accessible to park staff, managers, and the general public.

If you have a study you would like us to highlight, please send an email to: melissa_sladek@nps.gov