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Wyoming Citizen Science Conference

December 1-2, 2016
and December 3, 2016
Lander, Wyoming

Conference Program

University of Wyoming Biodiversity Institute

Conference Agenda

Thursday, December 1, 2016

All activities held at the Lander Community and Convention Center's Main Room unless noted otherwise.

7:00 am – Registration, breakfast available, poster set-up begins *(Lobby)*

9:00-9:15 am – Welcome and orientation

9:15-10:15 am – Keynote presentation and Q&A – Rob Miller

10:15-10:30 am – Break/change to concurrent sessions

10:30-11:30 am – Themed session 1:
"Moose Day Citizen Science: Jackson Edition" – Paul Hood
"Moose Day Citizen Science: Laramie Edition" – Brenna Marsicek
"Rocky Mountain Amphibian Project: Data quality control and dissemination" – Wendy Estes-Zumpf

11:30-12:30 pm – Lunch and WyoBio presentation – Teal Wyckoff

12:30-1:30 pm – Themed session 2:
"The Use of Geotagged Photographs to Enhance Citizen Science" – Michael Curran
"Using Citizen Science to help build meaningful online historical records of natural history specimen information" – Larry Schmidt
"Central Wyoming College: High Elevation Archaeology" – Todd Guenther

1:30-1:45 pm – Break/Change sessions

1:45-2:45 pm – Themed session 3:
"The Lander Butterfly Count: A decade of information collected by citizen scientists" – John Coffman
"How to Keep a Citizen Scientist Happy" – Barb Gorges
"Values Driving Conservation: Citizen Science as Interactive Art" – Jon Mobeck

2:45-3:00 pm – Break/change sessions

3:00-4:00 pm – Themed session 4:
"Lessons Learned: Eight Years of a Citizen Science Program in Jackson Hole" – Alyson Courtemanch
"Wyoming BioBlitz" – Jacelyn Downey

4:00-4:15 pm – Break/change sessions

4:15-5:30 pm – Plenary session on trespass law, Greg Nickerson and Temple Stollinger

5:30-7:30 pm – Reception and poster session / meet and greet / networking *(Lobby)*

7:30-9:00 pm – Reception continues (poster hosts need not stand by posters) *(Lobby)*

7:30-8:30 pm – Showing of "Far Afield" (optional activity)

Friday, December 2, 2016

All activities held at the Lander Community and Convention Center's Main Room unless noted otherwise.

9:00-10:00 am – Plenary session on Citizen Science and Next Generation Science Standards – Ana Houseal

10:00-10:15 am – Break/change to concurrent sessions

10:15-11:15 am – Themed session 5:
"Unfolding Meaning in Nature: Engaging At-Risk Students as Citizen Scientists" – Charlotte Edman Abelson
"Bringing Citizen Science into the Backcountry: Emerging Best Practices to Engage Outdoor Education Organizations" – Anya Tyson
"Citizen Science at NOLS: opportunities and challenges" – Shannon Rochelle

11:15-11:30 am – Break/change sessions

11:30-12:30 pm – Lunch and Brainstorming Session

12:30-1:30 pm – Themed session 6:
"Fundraising for Citizen Science: Experiences and Advice" – Kate Gersh, Anya Tyson, and Frances Clark

1:30-1:45 pm – Break/change sessions

1:45-2:45 pm – Themed session 7:
"CWC's Interdisciplinary Climate Change Expedition (ICCE) – Bridging the Divide Between Citizen Science and Undergraduate Research" – Jacki Klancher
"Where is the Science in Citizen Science?" – Brian Barber
"Could Applying Educational Frameworks to Citizen Science Projects Enhance Scientific Literacy?" – Zoe Nelson

2:45-3:00 pm – Break/change sessions

3:00-3:30 pm – Closing/wrap-up

3:30-5:30 pm – Optional workshop 1 (pre-registration required) *(Breakout room)*:
"Improving Science Communication with Wyoming Journalists and Media Outlets" – Kristen Landreville

Saturday, December 3, 2016

All activities held at the Fremont County Public Library - Lander Branch

10:00-12:00 pm – Option workshops 2 and 3 (pre-registration required):
"Little Feet- Big Maps: Lessons integrating the Wyoming floor map and Wyoming Student Atlas" – Germaine Wagner
"Audubon Rockies Bird Banding Program: Leveraging Citizen Scientists for Conservation Successes" – Dusty Downey

12:00-12:30 pm – Lunch

12:30-2:30 pm – Optional workshops 4 and 5 (pre-registration required):
"Learn how to use a GPS!" – Wendy Estes Zumpf
"Earth Rocks!" – Suki Smaglik

Oral Presentation Descriptions

Thursday, December 1, 2016

9:15-10:15 am – Keynote presentation, Rob Miller, *Intermountain Bird Observatory*

I gazed in wonder as I watched a pre-historic creature the size of a small car emerge from the surf, to do what her kind has done for more than 150 million years. I was working as a citizen scientist to help save this endangered species - the Leatherback Sea Turtle. On that dark moonless night, the assault of sandflies was relentless, sharp sand mixed with sweat covered my body, I was miserable and euphoric at the same time. I knew my life would never be the same. Since that day just over a decade ago, I have contributed to a number of other citizen science projects prior to making the transition to a full-time biologist. Now some of my professional responsibilities include the direct design and management of citizen science based projects.

I will share my perspective from my time as a citizen scientist and how that experience ultimately changed my life. I will pay particular attention to the key aspects of the projects that were most influential in engaging my interest. I will highlight a few of the citizen science based projects I have designed and spend time discussing what worked well and what did not. I will present a framework I use for defining projects and present my key tenants for success with citizen science programs.

10:30-11:30 am – Themed session 1:

"Moose Day Citizen Science: Jackson Edition," Paul Hood, *Nature Mapping Jackson Hole*

In collaboration with Wyoming Game and Fish Department (WGFD), Bridger-Teton National Forest and Grand Teton National Park, Nature Mapping Jackson Hole has hosted eight annual Moose Day surveys in since 2009. The purpose of Moose Day is to educate and engage citizen scientists while recording moose observations, document moose in areas that are difficult for the WGFD to survey, and contribute to tracking moose population trends in Jackson Hole over time. Over the years, 61 areas have been established to cover accessible moose habitat in Teton County. The areas are surveyed by volunteer teams using skis, snowmobiles, cars and on foot. In recent years, volunteers participate in a moose observation training the week prior to the survey. These trainings, and the fact that many of the moose day volunteers participate for multiple years, have resulted in improved data quality through increased observer confidence in accurately identifying age and sex of individuals.

"Moose Day Citizen Science: Laramie Edition," *Brenna Marsicek, University of Wyoming*

Based on the concept designed by Nature Mapping Jackson Hole, the UW Biodiversity Institute, Wyoming Game and Fish Department (WGFD), and Wyoming Cooperative Fish and Wildlife Research Unit have held a bi-annual Moose Day citizen science event in the mountains outside of Laramie. Participants adopt a pre-designed route, attend training, and all survey their routes on the same day at the same time. Because we accept multiple data forms as observation (animal, scat, tracks, sheds), and tracks and scat are easily confused with those of elk, data quality is variable and difficult to assess. We have used a few strategies to minimize error: 1) a required, 90 minute training a few days before the event; 2) identification tools provided to participants to take on their route; 3) duplicate data submission through paper data sheets and online WyoBio data submission; 4) strongly encouraged submission of photos for biologists to verify. This is an ongoing challenge, and we invite attendees to provide suggestions for increasing data quality.

"Rocky Mountain Amphibian Project: Data quality control and dissemination," *Wendy Estes Zumpf, Wyoming Game and Fish Department*

The Rocky Mountain Amphibian Project (RMAP) is a regional citizen science program that engages members from the community to adopt a pre-determined catchment (a set of streams, ponds, and wet meadows), attend a half-day training, and survey their catchments at least once per summer for evidence of egg masses, tadpoles, juveniles, and adults of frogs, toads, and salamanders. Running since 2014, the program engages approximately 75-100 volunteers per season to survey catchments in three national forests in Wyoming and Colorado. Collecting data from the volunteers and ensuring its accuracy is an expected, though no insignificant, challenge. Data dissemination to volunteers and the public is a high priority but often difficult to deliver because of time lags in data analysis. Suggestions from the audience for improving this process are welcome.

11:30-12:30 pm – Lunch and WyoBio presentation, Teal Wyckoff, *Wyoming Geographic Information Science Center*

The Wyoming Biodiversity Citizen Science Initiative, or WyoBio, is a tool for educators, students, hikers, anglers, biologists and many others. WyoBio uses the power of cutting edge programming technologies to provide online mapping and database structure and access to make biodiversity data from Wyoming available to anyone, anywhere. WyoBio allows users to upload an observation (or multiple observations) to the website and immediately see it on a map. Much of the power of WyoBio comes from existing professional species location data that includes thousands of observations. Map layers that can be explored include climate, geology, elevation, hydrology, and human disturbance, and multiple layers can be displayed simultaneously. With an extensive amount of data organized in an easy to use format, WyoBio is designed to appeal to both students and other interested citizens alike – sparking their interest in the natural world and its diversity of species. The mapping application is designed to capitalize on new tools available in the ever-advancing world of spatial technologies to meet the unique needs of the end user. Science standards-based lesson plans can be downloaded that are meaningful and use WyoBio to get students outdoors and using technology. WyoBio also provides access to resources such as identification guides, surveying protocols, supply lists, links and more.

12:30-1:30 pm – Themed session 2:

"The Use of Geotagged Photographs to Enhance Citizen Science," *Michael Curran, University of Wyoming*

A large number of existing citizen science programs encourage participants to submit photographs of phenology events, species of interest to the study, or other relevant images which can be catalogued and used for the benefit of the program. The majority of these studies ask the citizen scientist to submit a general geographic location along with their photos, with the description usually being a broad area (e.g., the name of a town, county, or national park). Studies which do not require photograph submissions also often only require a broad description of an area where data collection occurred. While it is beneficial to have this information, broad scale location descriptions may limit the ability to ask and answer specific questions related to how environmental variables may influence species of interest to the study (e.g., slope, aspect, elevation, soil type, climate, etc.).

In recent years, GPS technology has become available and is becoming increasingly more affordable to link specific geographic coordinates to photos. These technologies may enhance citizen science by allowing for specific environmental variables to be added as attributes to images and data submitted by citizen scientists. Different technologies and cameras will be discussed, various methods to add environmental variable data to geotagged photographs will be demonstrated, and overall benefits to using geotagged photographs will be summarized.

"Using Citizen Science to help build meaningful online historical records of natural history specimen information," *Larry Schmidt, University of Wyoming*

Many museums, archives and libraries are building online natural history collections. The University of Wyoming Libraries and the Rocky Mountain (RM) Herbarium are growing their online collections of images and digital specimens and exploring the ways in which citizen scientists can improve discovery and access for these collections. Historical collections such as the RM Herbarium's lichen and bryophyte holdings include little descriptive data other than labels on specimen sheets. Handwritten printed or cursive, typed, or a combination of scripts, these labels must be transcribed to be useful in an online database. Specialized portals like Notes for Nature can help citizen scientists transcribe label information and transfer valuable written documentation into research databases where the information can be searched. This transcribed information can include who collected the specimen, where it was collected, and other valuable details. Georeferencing and changing historical descriptive location information into longitude and latitude geographic coordinates to decimal format is another opportunity for citizen scientists, teachers and students to help build better online collections. This presentation will provide an introduction to the creation of online natural history collections and efforts to use citizen scientists to create more relevant online databases.

"Central Wyoming College: High Elevation Archaeology," *Todd Guenther, Central Wyoming College*

Central Wyoming College archaeology faculty have engaged in citizen science projects utilizing Elderhostels, as well as high school volunteers and community college students. Examples discussed will include sensitive excavations at the Esther Hobart Morris cabin site in South Pass City State Historic Site, an enrolled National Register of Historic Places site, and current controversial interpretations about the recently-discovered National Register–eligible Dinwoody Bison Jump located at 11,000 feet in the Wind River Mountains. The Dinwoody Bison Jump, 3,000 feet higher than other documented jump sites, was discovered in 2015 by community college students from CWC rather than a crew from a renowned research institution. Some colleagues in the professional / academic community resist accepting the validity of data collected by non-professionals. This has been especially true when the interpretation of the citizen science data disseminated at professional conferences or in publications challenges the accepted conventional wisdom. The presentation will cover a set of techniques for overcoming these obstacles.

1:45-2:45 pm – Themed session 3:

"The Lander Butterfly Count: A decade of information collected by citizen scientists," *John Coffman, The Nature Conservancy*

In 2017, the Lander Butterfly Count will mark its 10th year. Over the years, we have learned important lessons in keeping the effort simple and successful. The project combines fun and science in a way that is repeatable and consistent enough to collect useful biodiversity information.

"How to Keep a Citizen Scientist Happy," *Barb Gorges, Cheyenne – High Plains Audubon Society*

Barb Gorges was introduced to one of the oldest citizen science efforts, the Christmas Bird Count, in 1982, on sub-zero day in southeastern Montana. She also became an observer for Project FeederWatch in 1999 and has been entering birding checklists for eBird regularly since 2007. What got her started? The birds. What keeps her going? Tradition, easy data entry, personal data compilation, the community of citizen scientists (including competitive data collection!) and seeing what the data means to science.

"Values Driving Conservation: Citizen Science as Interactive Art," *Jon Mobeck, Jackson Hole Wildlife Foundation*

As citizen science continues to gain acceptance as a credible source of data and its resulting scientific output expands and improves, organizers and volunteers run the risk of deemphasizing some of its greatest contributions to conservation. The interactive art/experience of recording observations strengthens connections to local environments and can contribute toward a community's land ethic. As a tool to engage people anywhere, an appeal to the artistry of citizen science - opening new ways of seeing/being in the world - can be as effective as the scientific appeal. It can catalyze innovative ways of thinking that improve relationships among people and deepen a community's commitment to protecting local wildlife and wild lands. Curiosity and wonder have been central elements in such important conservation works as Aldo Leopold's "A Sand County Almanac." Leopold and many other early ecologists and natural historians deftly balanced the arts and humanities with their scientific work. While citizen science has become more technically advanced in recent years, it needs to continue to incorporate the intangible values that resonate with all people.

This presentation envisions an acceleration of the citizen science movement that embraces this bridge between disciplines. While calling upon stories of successful introductory science efforts in the Nature Mapping Jackson Hole program, it will also re-interpret the seminal work and philosophies of many 20th century conservation legends. In a playful and creative way, this presentation will highlight the joy of wandering and observing as if focuses on the wonder of citizen science.

3:00-4:00 pm – Themed session 4:

"Lessons Learned: Eight Years of a Citizen Science Program in Jackson Hole," *Alyson Courtemanch, Jackson Hole Wildlife Foundation and Wyoming Game and Fish Department*

Nature Mapping Jackson Hole is a citizen science program administered by the Jackson Hole Wildlife Foundation that began in 2009 in Jackson, Wyoming. What began as a grassroots citizen science program has grown into a large effort with over 350 trained Nature Mappers, multiple volunteer project leaders, and over 40,000 verified wildlife observations. With that growth, challenges have arisen over the past eight years. This presentation will describe those challenges and we have attempted to overcome them. These include volunteer engagement and retention, running the program with limited staff, ensuring data and project quality, developing technology for various ages and computer skill levels, and deciding when and how to share data. We aim to share lessons that we have learned over the life of the Nature Mapping Jackson Hole program in order to help other citizen science organizers learn from them.

"Wyoming BioBlitz: Bridging the Gap Between Citizens and Scientists," *Jacelyn Downey, Audubon Rockies*

Wyoming is home to a diverse group of plants and animals and there are many scientists who are working towards gaining a better understanding of what the relationships between species mean to our Wyoming home. However, there is often a vast disconnect between the scientists who study our biodiversity and the community members who live in and amongst it. To bridge that gap, leaders in the scientific community began organizing BioBlitzes. A BioBlitz is an event where volunteers, researchers, land managers and natural resource professionals conduct an intensive survey of the biological diversity of a natural area. Participants record observations of as many different organisms as possible in a 24-hour period. Here in Wyoming, the event typically takes place over a weekend in a new location each year.

The Wyoming BioBlitz team consists of Audubon Rockies, The Nature Conservancy, UW Biodiversity Institute, and The Wyoming Geographic Alliance. Each year, this team works to bring this experience to families, students, and community members who can actively take a role in learning about local plants and animals, make connections with people who share interests, and enjoy spending time outdoors engaging in a fun and education project. Volunteers learn how to report biological data anytime through WyoBio and e-bird so they can continue to be citizen scientists year-round. After 8 years of hosting BioBlitz events in Wyoming, coordinators have learned valuable lessons that maximize participation, balance scientific and educational goals, and ensure quality of the data collected and submitted. These lessons will be shared during this presentation.

4:15-5:30 pm – Plenary session on trespass law, *Greg Nickerson, Wyoming Migration Initiative (formly with WyoFile.com), and Temple Stollinger, University of Wyoming*

In 2015, the Wyoming Legislature passed a pair of laws creating the new crime of "data trespassing" on open land. This panel will cover the origins of the laws, which began in the wake of a trespassing lawsuit between the Western Watersheds Project (WWP) and private ranchers in Western Wyoming. WWP sought to collect water quality data from grazing allotments to be used in enforcement of the Clean Water Act, while landowners accused the group of trespassing on private land to access water sampling locations on public land. The Wyoming Data Trespass Act, passed originally by the Wyoming Legislature in 2015 made it a crime to trespass onto private land to collect without permission. The Wyoming Association of Conservation Districts, the Wyoming Farm Bureau, and the Wyoming Office of State Lands all supported the legislation, which was sponsored by Sen. Larry Hicks (R-Baggs), himself a conservation district employee.

Within months of the passage of the laws an attorney representing WWP wrote an opinion piece arguing the statutes could restrict citizens from taking photographs on public lands like Yellowstone National Park. The piece was shared more than 70,000 times and caused public outrage over the implications for citizen science. Four groups filed a lawsuit to overturn the laws, and in 2016 they were partially amended. Litigation on the statute is pending.

Description of Poster Session / Meet and Greet / Reception (5:30-9:00 pm)

There are dozens of citizen science programs running throughout Wyoming, some new and old. The poster session / meet and greet / reception event allows for all conference attendees to learn more about the programs described in the posters, meet the individuals running those activities, and network with other participants attending the conference. All over a glass of wine or pint of beer and heavy appetizers.

Descriptions of poster presentations begin on page 19.

Description of "Far Afield" (showing at 7:30-8:30 pm)

"Far Afield" is a documentary about a conservation icon, but it's also a love story involving two people, a place and an environment that inspires us all. Bert Raynes is a man everyone should have the joy of knowing. With a keen intellect, sharp wit and twinkle in his eye, 91-year-old Jackson Hole News&Guide columnist Bert Raynes inspires citizens to observe and care about their wild neighbors. Bird watchers and nature lovers have been eagerly reading Bert's column, "Far Afield," for more than three decades. Now, this new half-hour documentary reveals Bert – a force for nature – to the world. Young, old and in-between flock to him to discover how to be better stewards of the natural world.

The goal of this film is to introduce the world to Bert and his vision for how Citizen Scientists can play a meaningful role, working in tandem with experts, in caring for the wild places we love.

Friday, December 2, 2016

9:00-10:00 am – Plenary session on Citizen Science and Next Generation Science Standards, *Ana Houseal, University of Wyoming*

A Framework for K-12 Science Education promotes a vision of scientific learning and literacy through the engagement of students in three key integrated dimensions: content, scientific practices, and overarching themes. While citizen science projects typically engage people of all ages in much needed crowd-sourced data collection using specific protocols, within this movement there is a greater opportunity to actively engage participants more fully in the science. This presentation will explore the Framework and ways that it could be harnessed in citizen science projects to connect participants to the science beyond data collection.

10:15-11:15 am – Themed session 5:

"Unfolding Meaning in Nature: Engaging At-Risk Students as Citizen Scientists," *Charlotte Edman Abelson and Michelle Harper Zitek, Whiting High School, Laramie*

As the English and Math teachers at an alternative high school in Laramie, we struggle to engage students in meaningful experiences outside of the classroom in order to build a relationship with their community and environment. Over the past five to ten years, we've worked together to develop integrated, interdisciplinary classes and classroom experiences in order to support students in their engagement with the diverse ecosystem around them. Still, we believe we've fallen short.

Some of our past interdisciplinary classes have been a literary, geographical, and geologically-based approach to the oil drilling to Wyoming; a chemistry and culinary class; a collaboration on the literary, mathematical, geological, historical, and artistic approaches to the history of Wyoming; and a combined math-science class involved in local mapping.

Together we've developed an interdisciplinary semester-long unit on birds—adaptation, movement, diversity, and habitat through the lens of mathematics, creative writing, and literature. Our expected outcomes include data collection, design and publication of a field guide, as well as developing those skills needed to continue as citizen scientists in the future. We plan to continue the program to encourage a lifelong love of the outdoors and our ecosystem.

"Bringing Citizen Science into the Backcountry: Emerging Best Practices to Engage Outdoor Education Organizations," *Anya Tyson, University of Vermont*

The raucous, rolling squawks of the Clark's Nutcracker may not be musical, but they can nevertheless call outdoor adventurers to action. I launched a citizen-science partnership with the National Outdoor Leadership School and the Teton Science School to investigate the ecology of this seed-dispersing bird in Wyoming's western mountains. With user-friendly materials, face-to-face trainings, and accordion performances, I taught wilderness instructors about the crucial link between the Clark's Nutcracker and the imperiled Whitebark Pine. The lesson came with a mission: help us understand the bird's habitat preferences so we can help it to restore the pine. High in their mountain classrooms, educators engaged over 200 students in surveys for Clark's Nutcrackers. Using the summer's successes and pitfalls as landmarks, I will share a series of best practices to guide the field of citizen science deeper into the backcountry.

"Citizen Science at NOLS: opportunities and challenges," Shannon Rochelle, *National Outdoor Leadership School*

NOLS has been helping scientists collect data since the 1970s when instructors and students assisted the Shoshone National Forest in estimating the carrying capacity of what is now the Popo Agie Wilderness Area. More recently courses have collected data on pikas, bighorn sheep, water quality, glacial extent, and whitebark pine health. In 2016, we began a formalized Citizen Science Program with the goals of connecting more students to the natural world through scientific participation and supporting scientists in their research. NOLS courses spend long periods of time in remote places, offering a good opportunity and for students and instructors to learn more about science and our classrooms, and to help scientists collect important and difficult-to-obtain data. During the summer of 2016, more than 25 NOLS courses in Wyoming participated in one of three citizen science projects. This presentation will share what we learned this year and where we expect and hope that will take us in the future.

12:30-1:30 pm – Themed session 6:

"Fundraising for Citizen Science: Experiences and Advice," *Frances Clark, Nature Mapping Jackson Hole; Kate Gersh, Jackson Hole Wildlife Foudnation; Anya Tyson, University of Vermont*

This panel will discuss strategies and sources for fundraising for citizen science programs from the prospective of a graduate student (Anya Tyson, University of Vermont), a funder (Frances Clark, Meg & Bert Raynes Wildlife Fund) and a donee (Kate Gersh, Jackson Hole Wildlife Foundation). Discussion will consider fundraising for citizen science programs from the viewpoint that our work goes beyond the creation of scientific knowledge -- but is also about education, restoration, stewardship and community-building. Other perspectives will be shared such as, what donors look for in funding proposals and how researchers approach funding opportunities. Panelists will talk about process, challenges, successes, and lessons learned based on their respective experiences.

1:45-2:45 pm – Themed session 7:

"CWC's Interdisciplinary Climate Change Expedition (ICCE) – Bridging the Divide Between Citizen Science and Undergraduate Research," *Jacki Klancher, Central Wyoming College*

In August 2014, a team of students and faculty from Central Wyoming College launched the Interdisciplinary Climate Change Expedition (ICCE) - an initiative to expand student participation in field-based geoscience and hydrologic data collection and research. During the inaugural voyage of the project, a discrete research module was embedded within an existing Outdoor Education course. Over time, both the breadth and depth of ICCE projects, and the degree of year-round student involvement has increased considerably. ICCE students now commit to presenting at the University of Wyoming and completing student papers throughout the school year. Maintaining connections with those students (some of whom might graduate mid-year), and effectively managing the preparation of their papers and posters demands a well thought-out system of communication to ensure follow-through. Overall, however, ICCE has served as an effective model for facilitating the student transition from field sampling and data collection to full involvement in the scientific process.

"Where is the Science in Citizen Science?" *Brian Barber, University of Wyoming*

Citizen science is an exciting tool for engaging non-professionals in research. Engagement gives participants an increased appreciation of the place in which they live and pride in having contributed to our understanding of the natural world. In these projects citizens usually contribute observational data. But science is more than data collection. Science is a process and involves multiple stages of inquiry. The general public also misunderstands science. I contend that citizen science projects are missing a unique opportunity to further educate an already engaged audience about the scientific process. I will support my position with data from over 400 citizen science projects. These data will demonstrate that the vast majority of citizen science projects rarely go beyond data collection, fail to elaborate on their research questions, do not mention hypotheses, do not show how collected data are analyzed and in general how their research follows the scientific process. I will offer recommendation based on these findings and my own experiences with engaging the public in the scientific process.

"Could Applying Educational Frameworks to Citizen Science Projects Enhance Scientific Literacy?" *Zoe Nelson, University of Wyoming*

Citizen Science projects have grown in scope recently; data have been collected across a wide range of ecosystems and some projects have been long-lasting. Many citizen science projects aim to enhance participant understanding of the focal organisms, as well as encourage participants to experience the scientific process. There lies an underlying assumption that citizen science projects help people develop science literacy through participation. However, the role of citizen volunteers generally involves the collection of a specific set of data (contributory citizen science), and rarely involves engaging the participants in the entire scientific process (co-created citizen science). In this presentation, we aim to explore how citizen science and scientific literacy are defined and how these concepts may differ; we then suggest possible remedies to assist in bridging this divide.

Assessing the scientific literacy of participants in citizen science projects has been a key challenge in meeting the goals of citizen science. This raises the question: Could applying a framework to citizen science make the process more robust, encouraging engagement towards more co-created citizen science projects? Perhaps through the lens of previously constructed frameworks, such as the three dimensions of science learning proposed by A Framework for K-12 Science Education, which is the basis of the Next Generation Science Standards, citizen science projects could comprehensively engage participants in the scientific process, thus helping participants develop scientific literacy.

Workshop Descriptions

These workshops require pre-registration to participate. If you'd like to register during the conference, please visit the registration desk. Each workshop costs $25 to attend.

3:30-5:30 pm, Friday, December 2, Lander Community and Convention Center

Optional Workshop 1: "Improving Science Communication with Wyoming Journalists and Media Outlets," *Kristen Landreville, University of Wyoming*

Many Wyoming citizens still use traditional media for information (e.g., local print newspapers, Wyoming Public Media). Yet, more and more, Wyoming citizens now use social media (e.g., YouTube, Facebook) and local online news (LaramieLive, WyoFile) for sources of information. At the same time, local media are the primary disseminators of science information. Unfortunately, Wyoming journalists who specialize in science reporting are rare. Likewise, Wyoming citizens who are well-versed and equipped to speak with journalists and media outlets about science are also rare.

This workshop is designed to increase knowledge about how to communicate with journalists and media outlets about citizen science projects and scientific research in general. Special attention will be paid to (a) effectively promoting and marketing citizen science projects to receive media coverage, (b) effectively communicating science to the general public via mass media and social media, and (c) effectively speaking with journalists during interviews. Topics include: how to craft a succinct press release that shows impact, relevance, and significance to the community; how to effectively manage social media accounts, such as Instagram and Facebook, to encourage mass media to report on the citizen science project; how to engage in visual storytelling with photography and videography; how to use basic editing programs for photography and videography; how to avoid scientific jargon; how to speak eloquently and passionately for direct quotations; how to understand the goals of journalists; and how to create and maintain relationships with journalists. After the workshop, attendees will be excited and empowered, rather than nervous and hesitant, to communicate science to journalists.

10:00 am - 12:00 pm, Saturday, December 3, Fremont County Public Library - Lander Branch

Optional Workshop 2: "Little Feet- Big Maps: Lessons integrating the Wyoming floor map and Wyoming Student Atlas," *Germaine Wagner, University of Wyoming*

The National Geographic Society is encouraging alliances to become involved with citizen science programs to get students outdoors to discover their surroundings. The new 16x22 foot Wyoming floor map will be presented with lesson ideas developed by National Geographic. Students will also discover Wyoming with a hands-on/feet-on approach using the 12x12 foot floor maps of Wyoming and the Wyoming Student Atlas, which showcases locations of wildlife, vegetation, and physiographic features of the state. Participants will discover how to integrate the 50 various maps into curricula including outdoor adventures. Additional maps will also be presented on sagebrush habitat, watersheds and geologic formations in Wyoming.

Teachers will be introduced to the free materials available to enhance student learning about Wyoming as well as collaborative opportunities to incorporate Citizen Science.

Optional Workshop 2: "Audubon Rockies Bird Banding Program: Leveraging Citizen Scientists for Conservation Successes," *Dusty Downey, Audubon Rockies*

Scientists widely recognize the value of long-term monitoring, but rarely have the luxury of vast, meticulously curated data with which to work. Audubon Rockies has been organizing bird banding stations in Wyoming since 2004 where Audubon's Community Naturalists and dedicated volunteers set up mist nets at three stations to capture, collect data, and release live birds. This data collection helps researchers, land managers, and policy makers learn more about local bird survivorship and breeding. This data - collected largely by citizen scientist here in Wyoming and around the world, has led to more than 100 peer-reviewed papers and hundreds of reports on the vital rates of landbirds, and their relationships to climate, habitat, land management actions and other environmental variables.

On average, each station bands around 30 birds a day, but just as important are the 500 plus citizen scientists, community members, volunteers and children that visit our stations every year to learn about birds and the effort to conserve our Wyoming species.

During this workshop, participants will learn how to set up a mist net, how to band birds, and the data collection that is so vitally important for avian species.

12:30 - 2:30 pm, Saturday, December 3, Fremont County Public Library - Lander Branch

Optional Workshop 4: "Learn how to use a GPS!" *Wendy Estes-Zumpf, Wyoming Game and Fish Department*

Learn how to find what you are looking for, and then find your way back again by joining us for a GPS tutorial and scavenger hunt. Knowledge of how to navigate and record locations with a GPS unit is invaluable to many citizen science programs. GPS units are extremely useful tools both for science and recreation once you know how to use them properly. We will provide a brief tutorial on how to use some common GPS units. This tutorial will cover basic features of GPS units, as well as how to mark, label, and navigate to specific locations using a GPS unit. We will then test the skills you just learned by holding a GPS-guided scavenger hunt. This workshop is aimed at program organizers and educators who want to teach others how to use a GPS, and those who would like to learn these skills themselves. We will have a limited number of GPS units available for use. Please bring your own if you have one!

Optional Workshop 5: "Earth Rocks!" *Suki Smaglik, Agate Adventures/Laramie County Community College*

This will be a hands-on active workshop focusing on Wyoming's diverse geology, mining rocks and minerals, and connections to the end productions made from these resources. To begin, you will learn how to properly identify rocks and minerals (and what's the difference?). We'll discuss how Earth materials are extracted and what impact that has, including land reclamation, sustainability, and environmental issues. Bring your own samples to identify and use those provided by the instructor. This workshop may be followed up with local field trips.

Poster Presentation Descriptions

Thursday, 5:30-7:30 pm. *The poster session is a way for conference attendees to meet some of the citizen science programs and the people behind them in an informal, meet-and-greet session.*

"Nature Mapping Jackson Hole: Mapping Community Solutions," *Kate Gersh, Jackson Hole Wildlife Foudnation*

Jackson Hole Wildlife Foundation's program Nature Mapping Jackson Hole (NMJH) engages more than 300 volunteer citizens whose recorded wildlife observations of all local species create a valuable long-term dataset. Our proposal is to present a poster that illustrates how NMJH strives to fulfill wildlife observation and distribution needs not already covered by state and federal agencies or local research organizations. Certified Nature Mappers (i.e., those who have successfully completed a JHWF training session) enter their wildlife observations into our central database specific to our program. Since the program's beginning in 2009, a total of 43,549 unique wildlife observations has been recorded by NMJH.

Nature Mapping Jackson Hole is a program running continuously throughout the seasons. It is easy and fun for folks to participate as they enjoy long walks along the river or in the mountains, or just driving to and from home. The skills required are a curiosity about Jackson Hole's wildlife, a likeness for reporting a few details and a simple comfortability with technology.

"Monarchs and Milkweeds," *Lusha Tronstad, Wyoming Natural Diversity Database*

Monarchs and Milkweeds is a new statewide citizen science program in Wyoming that has two goals: better understanding the 2) distribution, timing, and reproduction of monarch butterflies in Wyoming, and 2) distribution and diversity of milkweed species in Wyoming. While biologists have heard quite a bit of anecdotal evidence that monarchs pass through Wyoming during their migrations, there is very little documented and verified evidence of this information. Monarchs and Milkweeds seeks to expand our database of monarch and milkweed species sightings in the state with photographed and vetted observations submitted by volunteers across Wyoming through the web portal WyoBio. Biologists review data submitted through WyoBio and approve observations if they are correct or make suggested changes if they are not. Approved observations are included in the larger database of monarch and milkweed documented observations.

"Fastest Toaders in the West: Using Volunteers to Recover the Critically Endangered Wyoming Toad," *Elizabeth Mack, U.S. Fish and Wildlife Service, Wyoming*

The U.S. Fish and Wildlife Service (Service) has been reintroducing critically endangered Wyoming toads onto public and private properties since 1996. In order to comply with the Endangered Species Act and facilitate recovery (delisting), a comprehensive monitoring plan is necessary to track the demographic and disease statuses of these reintroduced populations. This annual monitoring requires collecting a large amount of complicated data to accurately assess population trends. The level of effort required exceeds the capacity of existing staff, so the Service has relied on a large volunteer force since 2009 to complete annual monitoring surveys. Volunteer recruitment and ensuring the accuracy of collected data are annual challenges. By more effectively reaching out to our partners in conservation, the Service has been able to recruit enough volunteers each year so surveys can be completed in a timely manner. For the last two years, volunteers have included several private citizens as well as representatives from organizations including NGO's, state and federal agencies, the Wyoming Natural Diversity Database, the University of Wyoming, and a cadre of zoos across the country. To improve the quality of data collection, a mandatory survey training session was instituted to walk volunteers through survey protocols, toad processing, and data collection. As we look to the 2017 field season, we hope to streamline the survey process to better ensure accurate data collection and more effectively use our volunteers' time to survey a larger number of reintroduction sites in Laramie.

"Rocky Mountain Amphibian Project," *Wendy Estes-Zumpf, Wyoming Game and Fish Department*

The Rocky Mountain Amphibian Project (RMAP) is a regional citizen science program that engages members from the community to adopt a pre-determined catchment (a set of streams, ponds, and wet meadows), attend a half-day training, and survey their catchments at least once per summer for evidence of egg masses, tadpoles, juveniles, and adults of frogs, toads, and salamanders. Running since 2014, the program engages approximately 75-100 volunteers per season to survey catchments in three national forests in Wyoming and Colorado.

"WyoBio: The Wyoming Biodiversity Citizen Science Initiative," *Dorothy Tuthill, University of Wyoming*

WyoBio brings together students, the public, and professional research scientists with an interest in Wyoming's wildlife and natural heritage, for collaborative efforts in data collection, analysis, and public education. The project has been designed to make data entry and visualization as simple as possible, while maintaining visual interest and scientific sophistication. WyoBio accepts all observations from citizen scientists, and uses a network of professional and non-professional experts to verify accuracy. In addition to incidental observations, WyoBio is the repository for a number of local and state-wide data collection projects that will be mentioned on the poster. Furthermore, WyoBio contains species distribution data for a large number of species in the state, which can be accessed as observations or, in many cases, range and modeled distribution maps. Species information can be overlaid on more than 40 map layers, to address questions about geographic, climatic, and a variety of other limitations to species distribution. The poster will highlight some of the features that make WyoBio uniquely superior to other map-based data collection portals, especially in its capacity to deliver information to the user and to allow users to test hypotheses.

WyoBio is itself a collaborative venture, including the UW Biodiversity Institute, the Wyoming Geographic Information Science Center, the Wyoming Natural Diversity Database, and Wyoming educators.

"Learning more about a local wildlife species with the University of Wyoming Raccoon Project," *Rachel Fanelli, University of Wyoming*

The University of Wyoming Raccoon Project (UWRP) is interested in researching raccoon biology, behavior and cognition. The tendency of raccoons to exist alongside humans has provided the UWRP with a unique opportunity to engage with the public and encourage local citizens to get involved with scientific research. We do this by asking the public to inform us of their raccoon sightings and to consider granting us permission to trap on their property. We also encourage the public to record raccoon observations on Wyoming Biodiversity Citizen Science Initiative (WyoBio). The UWRP has been trapping, marking and tracking raccoons in Laramie, WY, since 2015, and 63% of these raccoons were captured on residential and business land. The UWRP has maintained a booth at a local farmers market so we can speak with the public about our research and to learn more about the location of raccoons in Laramie. This has resulted in numerous reports of raccoon sightings and the UWRP obtaining permission to trap in areas that require property owner permission. Considering the raccoon's propensity to live in the backyards of Laramie's residents, we view our relationship with the public as a necessity for the longevity of our research, and we intend to continue building ties with the community through our outreach efforts.

"Opportunities for Citizen Science in the Bighorn Mountains: Initiatives at Sheridan College," *Scott Newbold, Sheridan College*

As faculty in the Life Sciences department at Sheridan College, we are excited about the diverse opportunities for citizen science at two field sites in the Bighorn National Forest: the Spear-O Mountain Campus (SMC) and Beaver Lakes Field Station (BLFS). Both locations attract individuals from a wide cross-section of the community who are interested and willing to contribute to long-term data collection. During a citizen science brainstorming expedition to the BLFS during summer of 2015, we designed simple, but rigorous, phenological studies following protocols from the National Phenology Network Nature's Notebook. Undergraduate research projects with Sheridan College students, sometimes involving the help of community members, have resulted in the initial data sets that may serve as ongoing citizen science projects into the future. In particular, data sets that are part of yearly data collection efforts in Biology and Ecology courses taught at Sheridan College (rodent sampling; frog sampling) are perfectly poised to broaden their scope and become opportunities for citizen science projects. In addition, we also include students in classic long-standing citizen science efforts (e.g., Christmas Bird Count; Great Backyard Bird Count). Our poster will highlight existing projects and future directions while providing summary statistics by project regarding participant demographics, longevity of studies, and major accomplishments or lessons learned.

"Monitoring Wildlife Movement on South Highway 89," *Kate Gersh and Jon Mobeck, Jackson Hole Wildlife Foundation*

The Wyoming Department of Transportation (WYDOT) plans a major reconstruction of South Highway 89/191 (just south of Jackson) to begin in 2017. WYDOT has proposed six large underpasses and many smaller structures to facilitate wildlife movement and reduce wildlife vehicle collisions.

JHWF and our partners have jointly contributed funding to establish a technical application that will integrate camera trap images and data with JHWF's citizen science Nature Mapping Jackson Hole (NMJH) program. We are working to ensure that the information provided by the trail cameras will influence final HWY 89 design considerations to facilitate optimal wildlife movement, from the greatest array of species. Accurate analysis of the images will be provided by crowdsourcing the experience and training of Nature Mapping volunteers to analyze the wildlife observation details occurring in the images, recording it as meta data associated with the photographs. A dedicated webbased application will automate this process. As the website comes online, JHWF will expand the scope of the NMJH program to use its citizen scientists to assist with identification and information gathering via the camera trap imagery. For this presentation, we will demonstrate and lead a tutorial of the website.

"CWC's Interdisciplinary Climate Change Expedition (ICCE)," *Jacki Klancher, Central Wyoming College*

In August 2014, a team of students and faculty from Central Wyoming College launched the Interdisciplinary Climate Change Expedition (ICCE) - an initiative to expand student participation in field-based geoscience and hydrologic data collection and research. During the inaugural voyage of the project, a discrete research module was embedded within an existing Outdoor Education course. Students already participating in a CWC wilderness skills course in the Wind River Range of Wyoming simply extended their time in the mountains to engage in the project. While some of the students had participated in pre-field training prior to commencing sampling and data collection, others received instruction in-situ on the lateral moraine of the Dinwoody Glacier. Over time, both the breadth and depth of ICCE projects, and the degree of year-round student involvement has increased considerably. ICCE serves as a model for facilitating student transition from field sampling and data collection to full involvement in the scientific process. By inspiring curiosity in scientific analysis, and mentoring students in all phases of the scientific process, citizen science provides an excellent bridge towards increasing science, technology engineering and math (STEM) education and overall scientific literacy.

"Retracing Frank Craighead's steps: changes in plant phenology in the Tetons," *Corinna Riginos, Northern Rockies Conservation Cooperative*

The timing of many ecological events (phenology) – such as when plants flower or leaf out, or when insects emerge – is often closely linked to temperatures. As the climate continues to warm, many ecological events are occurring at different times than they did in the past. This is often the first sign that climate change is impacting natural populations, and may be an early warning of future population declines or even local extinctions. Phenology observations are also a popular way in which to engage citizen scientists. In the 1970s – before significant anthropogenic warming had occurred – noted ecologist Frank Craighead, Jr. collected numerous observations on first flowering time of plants in Grand Teton National Park. We located his original notes and converted them into digital data in the hopes that they could be considered viable "baseline" data against which to compare contemporary patterns of flowering time. From these data, we have seen that many flowering plants are highly sensitive to differences in temperature from year to year; we expect that plants are likely flowering about 25-30 days earlier now than they were in the 1970s. We have identified ideal species and a data collection protocol for citizen scientists to help collect contemporary data. This will provide important scientific insights into the ecological changes occurring due to climate change and will be a valuable education tool for citizens to engage in observing directly the impacts of climate change on the Tetons.