Proceedings
Eleventh Montana Plant Conservation Conference
March 30-31, 2022
Virtual on ZOOM

MONITORING FOR THE EFFECTS OF CLIMATE CHANGE

Montana Native Plant Society

The mission of the Montana Native Plant Society is to preserve, conserve, and study the native plants and plant communities of Montana, and to educate the public about the value of our native flora.

Montana Natural Heritage Program

The mission of the Montana Natural Heritage Program is to be Montana's source for reliable, objective information and expertise to support stewardship of our native species and habitats, emphasizing those of conservation concern.

U.S. Forest Service

The mission of the U.S. Forest Service is to sustain the health, diversity, and productivity of the Nation's forest and grasslands to meet the needs of present and future generations.

Hosted by Full Scope Management Inc.
Cover illustration of arctic willow (*Salix arctica*) by Debbie McNiel

Schedule

Wednesday, March 30

9:00-9:05 **Welcome and Introduction**

9:05-9:35 **The Future Climate and Distribution of Plant Species in Montana** Bruce Maxwell, *Montana State University*

9:35-10:00 **Goat Flat Climate Change Monitoring**. *Jessie Salix, Beaverhead-Deerlodge National Forest*

10:00-10:30 **Monitoring Changing Ecotones in Wetlands** Dave Hanna *The Nature Conservancy*

10:30-10:45 Break

10:45-11:15 **Southern Margin Populations: Looking for Early Signs of Global Warming** Peter Lesica, *University of Montana*

11:15-11:45 **Western Bumblebee Sampling Initiative** Tabitha Graves & William Janousek, *USGS Glacier Field Station*

11:45-12:15 **Monitoring for the Effects of Climate Change on Plants Pollinators and their Interactions**. Laura Burkle, *Montana State University*

12:15 Additional questions and Adjourn

Thursday, March 31

9:00-9:30 **Insights on GLORIA Sites**, Martha Apple, *Montana Tech*

9:30-10:00 **Challenges and Strategies for Long-tern Plant Monitoring** Brian Smithers, *Montana State University*

10:00-10:30 **Hager Lake Fen Monitoring; Sixty Years of Change** Derek Antonelli, *Idaho Master Naturalist Program*

10:30-11:00 **The USA-NPN: A National Network for Collecting, Storing, and Sharing Phenology Data and Information** Erin Posthumus, *USA National Phenology Network*

11:00-11:15 Break

11:15-11:45 **Challenges and Strategies for Implementing a Successful Volunteer-based Rare Plant Monitoring Project**. Wendy Gibble, *University of Washington Botanic Gardens* and Walter Fertig, *Washington Natural Heritage Program*

11:45-12:15 **Montana's New Threat Tracking System** Andrea Pipp, *Montana Natural Heritage Program*

12:15 Additional questions and Adjourn

Abstracts

The Future Climate and Distribution of Plant Species in Montana

Bruce Maxwell, *Montana Institute on Ecosystems, Montana State University*

Plant distributions are thought to be driven by climate and how climate interacts with elevation as well as other abiotic and biotic environmental factors. Predicting future distributions is complicated especially when resources that can determine plant productivity are changing in ways not previously observed. Paleobiology indicates that warming periods during the Holocene were correlated with increased monocots. Species distribution models driven by climate were linked with climatic projection models to predict future mid-century common Montana and weed and tree species distributions. Model projections suggest that some species will increase in area occupied and some will decrease. It is not completely clear if species will move up or down in elevation. It is also not clear how species will react to increased atmospheric CO^2 concentrations and at the same time interact with dramatically higher mid-growing-season temperatures. Precipitation patterns already taking place with increased precipitation in the Fall and Spring coupled with longer growing seasons and projected hotter drier summers will favor winter annual grasses which are mostly non-native and are likely to increase rangeland wildfire frequency.

Goat Flat Climate Change Monitoring

Jessie Salix, *Beaverhead-Deerlodge National Forest*

Climate change monitoring was established in the Goat Flat Research Natural Area located in the Anaconda-Pintler Wilderness, along the Continental Divide in 2016. Monitoring occurs at 9,000 feet elevation in an alpine community. Two monitoring transects were established on August 1st, adjacent to a semi-persistent snow field. The transects cross through the transition zone from drier high elevation rocky bench vegetation to moist snow melt vegetation. The goal was to establish a baseline of vegetation composition along this ecotone in order to detect vegetation change over time in a warming climate with reduced soil moisture. One transect has 40 0.5 x 0.2 meter quadrats; the other has 20 contiguous 1 meter^2 quadrats. Percent cover was estimated for matt-forming species and the presence of standing water; while distinct individuals or flowers were counted. Several photo points were established, and size of snow bank was measured. Data were collected on August 1st in both 2016 and 2019 and intended to occur on the same date in future years.

Monitoring Changing Ecotones in Wetlands

Dave Hanna, *The Nature Conservancy of Montana*

Biological diversity should be monitored at multiple levels and spatial scales to be effective. Ecotones are boundaries between different plant associations. They often mark the physiological and/or competitive limit of one or more dominant species. Ecological theory suggests that changes will often occur first at the margin of a plant's occurrence. Monitoring the change in density and size of dominant plants at ecotones should provide insight into landscape-level plant community dynamics and allow rapid detection of ecological change.

Twenty-year monitoring studies examined changes across ecotones in a peatland on The Nature Conservancy's Pine Butte Swamp Preserve in northwest Montana. In one study, canopy cover and height of *Betula glandulosa* and *Dasiphora fruticosa* were measured across carr-dwarf carr ecotones. Results suggest that birch-dominated carr vegetation is increasing in cover and height, possibly at the expense of the lower-stature and more diverse cinquefoil-dominated dwarf carr. This could be due to changes in hydrology. A second study measured of *Trichophorum cespitosum*, a circumboreal plant at the southern margin of its range adjacent to vegetation dominated by *Schoenoplectus acutus*, a widespread bulrush in North America. Results suggest that the increase in *T. cespitosum* came, in part, at the expense of *S. acutus*, leading to a hypothesis of declining water movement and oxygenation in this portion of the peatland.

Southern Margin Populations: Looking for Early Signs of Global Warming

Peter Lesica, *Division of Biological Sciences, University of Montana*

Climate change is predicted to cause a decline in plant populations at the southern margin of their range, but this hypothesis has rarely been tested. I used permanent plots to monitor the density of 46 populations representing 28 species of arctic-alpine or boreal plants at the southern margin of their ranges in the Rocky Mountains of Montana between 1988 and 2014. Elizabeth Crone and I analyzed population trends and relationships to taxonomy and habitat. Marginal populations declined overall during the two decades of the study; however, the mean trend for 18 dicot populations was -5.8% per year, but only -0.4% per year for the 28 populations of monocots and pteridophytes. Fen populations declined less than tundra and forest populations, but this difference was not statistically significant. Results of this study support climate-change predictions and suggest that vulnerability may depend on phylogeny or associated anatomical/physiological attributes.

Western Bumblebee Sampling Initiative

Tabitha A. Graves & William Janousek, *U.S. Geological Survey, Northern Rocky Mountain Science Center*

The western bumble bee (*Bombus occidentalis*), once common throughout western North America is under consideration for listing by the U.S. Fish and Wildlife Service (USFWS). An initial analysis suggested the probability of local occupancy in the continental United States declined by 93% over 21 years from 0.81 (95%CRI = 0.43, 0.98) in 1998 to 0.06 (95%CRI = 0.02, 0.16) in 2018. Large spatial gaps in recent sampling, including in Montana, led us to propose a bumblebee community sampling design to address this. We will give an overview of the sample design, which involves repeated visits to distributed survey sites on public lands. The protocol involves sampling the site for 45 person minutes using hand nets, along with basic habitat data collection. Results will inform land managers about the full bumblebee community and can be pulled into developing national level databases. I will share updates on how we've incorporated these data into recent analyses and the current predicted spatial distribution of western bumblebees in Montana.

Monitoring for the Effects of Climate Change on Plants, Pollinators, and Their Interactions

Laura Burkle, *Department of Ecology, Montana State University*

We will discuss the benefits and limitations of different methods that can be used to monitor the potential effects of climate change on flowering plants, pollinators, and their interactions. We will focus mainly on observational methods to assess changes in survival, growth, reproduction, phenology, and/or behavior of these groups of organisms across space and time.

Insights on GLORIA Sites

Martha Apple, *Department of Biological Sciences, Montana Tech*

The Global Observational Research Initiative in Alpine Environments (GLORIA) consists of a vast network of mountain target regions established for long-term monitoring of alpine plants with respect to climate change. Alpine plants are sensitive to climate change, and mountains are subject to elevation-dependent warming (EDW). Each GLORIA site is known as a target region and consists of summits established along an elevational gradient. While the actual positioning of the GLORIA summits is dependent on topography, a range of four sites ranging from the tree line to lower alpine to upper alpine to the nival zone of snow and ice. At each summit, researchers conduct extensive surveys of plant species presence and distribution and install soil temperature sensors with hourly measurements at each of the cardinal directions (N, E, W, S). Sites are resurveyed at five-year intervals and initial and resurvey data are submitted to the GLORIA Coordinating Office in Vienna, Austria. Detailed instructions for the establishment of GLORIA target regions are presented in the GLORIA Field Manual. GLORIA target regions can serve as springboards for related research on alpine plants and climate change.

GLORIA Extensions: Challenges and Strategies for Long-term Plant Monitoring

Brian Smithers, *Department of Ecology, Montana State University*

In order to examine trends in plant communities in response to climate change, long-term monitoring with a consistent protocol is required. It is relatively easy to implement monitoring projects at a local scale, however making sure that those initial investments result in actual long-term monitoring data is very difficult. Many "long-term" projects that were promising at their inception have not persisted due to a variety of challenges faced by long-term projects. In this session, we will explore some of those challenges, how those challenges can be met, and how managers can effectively use citizen scientists to ensure the longevity of plant monitoring projects. We will use the GLORIA Great Basin organization as a model for how citizen scientists can be, not just field-hands in long-term monitoring, but can be the solution to long-term monitoring challenges. Citizen scientists are increasingly important in conducting science as both budgets for field crews shrink and the need for a reconnection between the public and science grows.

Hager Lake Vegetation Study: Sixty Years of Change

Derek Antonelli, *Idaho Master Naturalist Program* and *Idaho Native Plant Society*

Hager Lake Fen surrounds a lake of about five acres with a one-acre floating *Sphagnum* moss mat. The fen has an extensive scientific legacy including a vegetation study completed in the early 1950s by Washington State University graduate student (and future Montana State University professor), John Rumely. In 1992, Rob Bursik and Bob Moseley conducted a project to revisit the vegetation work completed by Rumely and focused on changes of the 40-year period. In 2012, the Idaho Master Naturalist Program took on the project to repeat the Rumely's early vegetation work and Bursik and Moseley follow-up work. We used the same methodology used by the earlier researchers so the results obtained could be compared directly to the earlier results. Our vegetation study was broken into three areas—a floral survey, a rare plant survey, and vegetation sampling. This study has some implications for monitoring climate change. Any system set up for monitoring climate change needs to look at long time frames. A climate change monitoring system must also have a consistency of monitoring methods to make results comparable over time. Finally, a climate change monitoring system needs to be able to account for changes that are not a result of climate change.

The USA-NPN: A National Network for Collecting, Storing, and Sharing Phenology Data and Information
Erin Posthumus, *USA National Phenology Network*

Changes in seasonal events of plants and animals, called phenology, are among the most sensitive biological responses to climate change. Across the world, the timing of many seasonal events is changing, though not all species are changing at the same rate or in the same direction. How plants and animals respond can help us predict whether their populations will grow or shrink – making phenology a leading indicator of climate change impacts.

The USA National Phenology Network collects, organizes, and shares phenological data and information to aid decision-making, scientific discovery, and a broader understanding of phenology from a diversity of perspectives. Through USA-NPN's *Nature's Notebook* program, professional and volunteer scientists use standardized protocols to record long-term observations of plant and animal life stages. Hundreds of partners across the country use the program to meet their needs for phenology monitoring, creating shared observation locations to track focal species and answer locally-relevant questions. The USA-NPN also produces maps of the start of spring, forecasts of insect pest and invasive plant activity that are used to time treatment activities, forecasts of temperature accumulation, and more. This presentation will describe how to access and use the products and tools available to you to inform your work in plant conservation.

Challenges and Strategies for Implementing a Successful Volunteer-based Rare Plant Monitoring Project.
Wendy Gibble, *University of Washington Botanic Gardens* and Walter Fertig, *Washington Natural Heritage Program*

Numerous examples of successful community monitoring programs exist across the United States. These programs fill a need for basic ecological monitoring that is vital to long-term conservation and management of species and ecosystems. There are a number of examples of programs for monitoring rare plant populations that employ different strategies for data collection, including programs that focus on organized, botanist-led group trips to programs where volunteers work independently or in self-led small groups. Washington Rare Plant Care and Conservation (Rare Care) initiated a rare plant monitoring program in 2001 in collaboration with the Washington Natural Heritage Program that was modeled on the program developed by the New England Wildflower Society. The goal of the Washington program is to update inventories on occurrences of rare plant species in Washington State, to provide land managers with data they need to track the status of populations on their lands, and to identify immediate threats to rare plant populations.

Since its inception in 2001, over 400 volunteers have participated in the project and over 3,000 site visits have been made and reported on across the state. The success of the program stems from successful collaboration between Rare Care and the

Natural Heritage Program that provides a structure through which the data are managed and shared, a well-developed quality assurance program that provides a framework for ensuring quality data are produced, and strong partnerships with public agencies managing lands where rare plant populations occur.

Montana's New Threat Tracking System
Andrea Pipp, *Montana Natural Heritage Program*

Since 2006 there has been a joint effort by the Montana Native Plant Society and the Montana Natural Heritage Program (MTNHP) Botanist to gather data and assess the threats facing our Species of Concern vascular plants. Now in 2021 Montana has a central threat tracking system that connects with the State's botany database and state ranking process. Plant profiles on the Montana Field Guide show the State threat score, rationale, and soon the calculations (https://fieldguide.mt.gov/). The threat tracking system can store threat information at the observation, Species Occurrence, or state-wide levels. Further, the system allows for threats to be quantified and assessed through time to maintain accurate threat scores. Andrea's presentation will touch on the history that led to this new system, how it works, and how people can contribute information to help maintain accurate threat scores and state ranks.