Co-producing knowledge on montane forest ecohydrology using very high-resolution observations and models

Presenter's Name: Adrian Harpold
Presenter's Company/Employer: University of Nevada, Reno
Presenter's Title: Assistant Professor
Topic: Technology in natural areas conservation
Proposal Type: Individual Presentation

Abstract:
Forest ecohydrology is critical to the prediction of future water supplies and ecosystem services. The spatial arrangement of trees, and other high-resolution information on forest canopy, can have dramatic effects on processes like snow melt with cascading impacts on water availability. Working with forest and water mangers in the Sierra Nevada, California, we have developed new modeling and observational systems to provide information to support decision making around forest treatment type and location. Observational tools include airborne-based lidar, which allows for three-dimensional information on forest structure and 1-meter scale snow depth maps. Unmanned aerial vehicles can collect thermal images at ~10 cm resolution that can information the energy state of the snowpack or fraction of incoming energy used for evaporation. We combine these high-resolution observations with physically-based models to both parameterize and verify their predictions of future hydrology. We will highlight a number of case studies in this talk. First, the sensitivity of snow processes to forest removal using lidar observations and high-resolution snowpack modeling for the Lake Tahoe Basin. This project co-produced information with the U.S. Forest Service and provided a decision support tool for forest managers. A second case study will examine the potential to use high resolution thermal imagery to map tree water stress in very high resolution in Sagehen Creek experimental watershed. The final example will explore the utility of high-resolution modeling to estimate the long-term feedbacks between tree growth and snowpack change, including the role of forest disturbance and climate change. Our central thesis is that high-resolution observations are available and can increase model fidelity in many fields, but that challenges remain in harnessing new datasets into existing models and translating results into management-relevant information.

Novel Use of Passive Acoustic Recorders for Mapping Coyotes on Public Lands

Presenter's Name: Claudia Pighetti
Presenter's Company/Employer: University of Nevada, Reno
Co-Presenter's Name: Danielle Miles
Co-Presenter's Company/Employer: University of Nevada, Reno
Topic: Technology in natural areas conservation
Proposal Type: Poster Presentation

Abstract:
Claudia Pighetti, University of Nevada - Reno Danielle C. Miles, University of Nevada - Reno Dr. Kevin Shoemaker, University of Nevada - Reno Passive acoustic technologies are changing the way habitat managers track wildlife by providing increasingly low-cost detectors that can be deployed for weeks to months without maintenance. In northern Nevada, a highly understudied region, the use of passive acoustic recording has transformed and simplified long-term species monitoring, bringing forth new opportunities for understanding species presence in lands in northern Nevada experiencing pinyon-juniper removal. To monitor the effects of pinyon-juniper removal on songbirds, we deployed Wildlife Acoustics SM4 passive recording devices for 3 field seasons (2017-2019) in 5 regional project areas distributed widely across the Great Basin in Nevada: Sheldon National Antelope Refuge (USFWS), Ely region (BLM & Mount Grafton Wilderness Area) Elko/Ruby Mountain region (BLM), Vya region (BLM), and Austin region (USFS). In nearly 200 5-minute sound files, we have manually detected howling coyote (Canis latrans) packs using sound visualization software (RavenPro) and anticipate more occurrences in the 2020 summer field season. Coyotes are the most abundant mammalian predator in northern Nevada and their populations affect natural biodiversity and grazing activities alike. This makes efforts to map their habitat use and activities important to land managers, ranchers, and field ecologists. This study explains how we have used passive acoustic technologies and how they can be adapted in future studies across disciplines, specifically by 1) summarizing seasonal coyote habitat use along the sagebrush to pinyon-juniper vegetation gradient , 2) demonstrating the use of triangulation to identify and locate coyote pack vocalizations, and 3) reporting on the costs and benefits of using passive acoustic detectors for monitoring coyotes. Passive acoustic recording has made possible efficient, wide-spread species monitoring on northern Nevada's public lands and will allow more opportunities to gain a better understanding of habitat use in Nevada's understudied regions.

Estimating biomass of chaparral shrublands in Southern California using Landsat NDVI

Presenter's Name: Charlie Schrader-Patton
Presenter's Company/Employer: USDA Forest Service/RedCastle Resources Inc
Presenter's Title: Senior Geospatial Analyst
Topic: Technology in natural areas conservation
Proposal Type: Individual Presentation

Abstract:
Co-Authors - Emma C. Underwood Research Scientist, University of California, Davis Hugh D. Safford Regional Ecologist, USDA Forest Service Pacific Southwest Region The Mediterranean-type climate region of southern California is dominated by chaparral shrublands. Chaparral regulates essential ecosystem functions and provides critical ecosystem services such as water, air quality, recreation, wildlife habitat, biodiversity, and carbon storage. Today, chaparral shrublands are experiencing wildfires with increasing frequency compared to pre-European settlement and dramatic increases in the area burned. The four National Forests in southern California are dominated by chaparral shrubland, and the USDA Forest Service is interested in understanding the impacts of wildfire disturbance on ecosystem services. Essential to this task, is understanding the initial loss and subsequent recovery of aboveground biomass in chaparral owing to wildfire. To address this issue, we developed a method to estimate chaparral biomass using the deep temporal record of Landsat imagery and precipitation as time-dependent predictors. We used Random Forest, an ensemble machine-learning algorithm, to build an aboveground live biomass model using over 700 field plots from several sources. By using Landsat Normalized Differential Vegetation Index (NDVI) images and precipitation raster layers for each year from 2000 to 2018, we are able to track biomass loss and recovery due to wildfire. Our model estimates compare favorably to field collected data on aboveground live biomass, thereby providing an important contribution to understanding how wildfire disturbance affects the ecosystem service of carbon storage in southern California. These methods rely on readily available data (i.e., Landsat) and therefore are applicable to assessing biomass in Mediterranean-type climate shrublands worldwide.

Detecting change in high elevation forests: disturbance monitoring with the Ecosystem Disturbance and Recovery Tracker

Presenter's Name: Michele Slaton
Presenter's Company/Employer: US Forest Service Region 5 Remote Sensing Lab
Presenter's Title: Ecologist
Topic: Technology in natural areas conservation
Proposal Type: Individual Presentation

Abstract:
High elevation white pine forests dominate upper treelines of the American West from the Sierra Nevada to the Great Basin and northern Rockies. Whitebark pine (Pinus albicaulis) is a major component of these forests, and is a federal candidate species under the Endangered Species Act, due to threats from climate change and insect and disease outbreaks. The remote and rough terrain and short growing season of these forests make traditional field or airborne monitoring difficult to implement with the frequency required to track rapid changes at broad scales. Operational remote sensing methods that concurrently detect forest anomalies and characterize magnitude of change are in great demand. The Ecosystem Disturbance and Recovery Tracker (eDaRT) is a highly automated, broadly applicable disturbance mapping system that processes all available Landsat imagery, detecting change at 8-16 day timestep, and is operated by the US Forest Service Pacific Southwest Region to generate disturbance map products for science and land management applications. We report on a newly developed method to estimate canopy loss using time series of spectral change associated with eDaRT disturbances. We used training data from high resolution imagery analysis and field plots across California's high elevation forests to develop a regression model for canopy cover loss as a function of eDaRT spectral change. The resulting eDaRT Mortality Magnitude Index (eMMI) combines vegetation indices known to be related to vegetation cover, moisture, and health, including the Normalized Difference Vegetation Index, Normalized Burn Ratio, and Red-Green Angle. Canopy cover loss was best modeled by including variables representing both proportional and absolute spectral change and their temporal variability, yielding a root mean square error (RMSE) of 13%. We provide an overview of plans for operational implementation of this tool for the Pacific Southwest Region of the Forest Service, and its potential to improve the accuracy and efficiency of delivery of forest change products for researchers and managers.

Developing a Plant Community Targeting Tool for Ecological Restoration in Pennsylvania

Presenter's Name: Ephraim Zimmerman
Presenter's Company/Employer: Pennsylvania Natural Heritage Program
Presenter's Title: Science Director
Topic: Technology in natural areas conservation
Proposal Type: Individual Presentation

Abstract:
Understanding what plant species may thrive at a particular site is important in ecological restoration activities and greatly benefits from a solid understanding of a site's ecological characteristics. Identifying a target natural plant community, a group of species occurring together on the landscape driven by ecological site characters, can be a key component of a restoration activity. Since the late 1990s, the Pennsylvania Natural Heritage Program (PNHP) has collected plot-based plant community data, which include species composition and structure information as well as ecological site data. These data, which have been used to drive the development of Pennsylvania's plant community classification and to determine rare natural plant communities in the state (used in the state's environmental review process) are also available to guide restoration planning. This presentation will review a new tool developed by PNHP and NatureServe, which uses the PNHP plot data and geospatial information to determine the plant communities and plant species that may exist at a specific site based on the similarity of each site to classified plots in the Heritage Program's plots database. The tool was designed to be utilized by wetland consultants, regulators, and land managers to provide site specific planting recommendations for restoration activities. We believe that a better understanding of the plant community types that are found at a specific site will benefit native wildlife species, lessen the overall negative ecological impact of development activities, and improve the successes and sustainability of restoration projects.

Are Talus Sites Important Winter Habitat? A Case Study Monitoring Rare Mammals in Northwestern Nevada

Presenter's Name: Danielle Miles
Presenter's Company/Employer: University of Nevada, Reno
Presenter's Title: Doctoral Candidate
Co-Presenter's Name: Claudia Pighetti
Co-Presenter's Company/Employer: University of Nevada, Reno
Co-Presenter's Title: Undergraduate
Topic: Technology in natural areas conservation
Proposal Type: Individual Presentation

Abstract:
Talus deposits, the rock formations associated with scree at the base of mountains or cliffs, are important habitats of western North America that provide year-round shelter to a diversity of small mammal species. Rocky habitats such as talus are also long-term refugia against increasing climate variation as organisms can be buffered from the temperature extremes being experienced in more open environments. However, little is known about how rare and threatened mammal species use these buffered habitats for thermoregulation throughout the winter months. The American Pika (Ochotona princeps) is a known rock-dwelling obligate in northwestern Nevada, but previous studies have yet to describe winter activity patterns in pika, in large part to the difficulty of accessing remote areas in snow conditions. In contrast to pika, some bat species that roost in rock crevices during the summer are thought to migrate to warmer locations during the winter, though many bat species are understudied because of their difficulty to capture, tag, and track. Here, we present a novel method of monitoring pika and bat activity through the winter season using passive acoustic detectors. In October 2019, we deployed sets of Wildlife Acoustics SM4 and SM4 Full Spectrum recorders with iButton temperature loggers at 9 talus sites in northwestern Nevada on BLM land and in Sheldon National Wildlife Refuge for 6 months. American Pika vocalizations were identified manually in RavenPro sound visualization software and bats were identified to species using Sonobat. With these new methods, we were able to 1) describe the activity patterns of pika in relationship to available sunlight and temperature fluctuations at sites with known pika presence in the summer and 2) compare bat species richness across seasons for the 15 species we have recorded in the region from 2017-2019. By developing this protocol for assessing presence and activity for rare and hard to track mammals, we are providing land and wildlife managers with the low-cost tools needed for seasonal monitoring in order to understand short- and long-term changes to talus habitats.

A study of landscape-level habitat relationships between birds and vegetation on the Modoc Plateau

Presenter's Name: Jaime Ratchford
Presenter's Company/Employer: California Department of Fish and Wildlife
Presenter's Title: Environmental Scientist
Topic: Technology in natural areas conservation
Proposal Type: Individual Presentation

Abstract:
Occupancy models often provide easy to interpret variables but are difficult to translate into spatially explicit information at a landscape-level. The California Department of Fish and Wildlife Vegetation Classification and Mapping Program is examining the relationship between wildlife communities and how these relationships can be extrapolated across a large geographic area using fine-scale vegetation mapping in the Modoc Plateau. The Modoc Plateau is an area of California with a low human population, yet strongly affected by human-caused disturbances and rapid changes in vegetation patterns. Vegetation classification and mapping of 1.2 million acres of this region began in 2016, providing quantitative spatially explicit vegetation information to be co-analyzed with high-density bird survey data collected in the 2018 and 2019 field seasons. Field crews collected bird occupancy data using digital recorders at 308 sites during the breeding season in 2018 and 2019. Sites were selected according to a stratified sample allocation covering 15 of the most common terrestrial and wetland vegetation types in the ecoregion. These data are being used to build and test a series of occupancy models for birds of the area, including the declining greater sage-grouse, in order to clarify landscape-level habitat relationships between bird species and regionally important vegetation types. This study is expected to have a significant impact on statewide wildlife habitat assessment and will revise and refine current habitat modeling practices and assumptions state-wide.