# Montana Chapter
# Society for Conservation Biology

## 5th Annual Research Symposium
## October 24-26, 2012

## Museum of the Rockies and Montana State University, Bozeman, MT

## FULL SCHEDULE WITH ABSTRACTS:

**WEDNESDAY, OCTOBER 24TH –**
**MUSEUM OF THE ROCKIES AUDITORIUM:**

**Registration 5:30-6:00**

**Plenary Lecture 6:00-7:00**
CHARACTERISTICS OF AN UNEXPLOITED WOLF POPULATION, AND MANAGEMENT IN NATIONAL PARKS
**Dr. Doug Smith**. Leader - Yellowstone Wolf Project, Yellowstone National Park.

Doug Smith will present the results of his extensive work studying the wolves of Yellowstone National Park. Additionally, he will discuss National Park wolf management philosophies and challenges in both United States and Canadian parks.

**Beer/wine reception and museum visit 7:00-9:00**

**THURSDAY, OCTOBER 25TH –**
**MSU STUDENT UNION BUILDING BALLROOMS:**

**Registration and Breakfast 7:30-8:30**

**Opening Remarks: 8:30-8:40**
**Rebecca McCaffery**, MTSCB President, Bozeman.

**Session 1: Invasive Species 8:40-9:40**
8:40-9:00
PROTECTING NATIVE LANDSCAPES WITH DOGGED DETERMINATION: A NEW MODEL OF DETECTION DOG SURVEYS AS NOXIOUS WEED ERADICATION TOOL
Aimee Hurt**.** Working Dogs for Conservation, Three Forks.
Kim Goodwin. Department of Land Resources and Environmental Sciences, Montana State University, Bozeman.
Marilyn Marler. Department of Land Resources and Environmental Sciences, Montana State University, Bozeman.
Dalit Guscio, Deb Tirmenstein, Maggie Heide, Deborah Smith, and **Megan Parker**. Working Dogs for Conservation, Three Forks.

Invasive weeds are a serious problem facing conservation managers today, given their ability to rapidly spread and out-compete native plant communities. In 2011, we investigated the capabilities of conservation detection dogs to find the highly invasive weed, Dyer's woad (*Isatis tinctoria*) on Mount Sentinel in Missoula, Montana. From June to October, two trained dogs were deployed in a systematic search to detect plants on a 200 acre affected area. During the season, teams located 388 plants in 132 locations. Early in the season when surrounding vegetation was short and many large plants were located, dogs and handlers contributed evenly to locating plants. Later in the season, dogs out-performed their handlers by finding 85% to 97% of all plants found. Dogs led to the discovery that new woads sprouted from remnant roots left from hand-removed plants, thus in 2012 spot-treating herbicidal application was added to the treatment protocol. In 2012, humans searched the study area first, and then dogs searched on subsequent days and located over 165 woad plants that were not initially found by human searchers. Based on two years of effort, we demonstrate conservation dogs can improve levels of eradication, and increase frequency, coverage and efficacy of weed removal.

9:00-9:20
A SEA OF GRASS: DECREASED PLANT AND ARTHROPOD RICHNESS WITH OLD WORLD BLUESTEM GRASSES
**Adam B. Mitchell.** Department of Ecology, Montana State University, Bozeman.
Andrea R. Litt. Department of Ecology, Montana State University, Bozeman.
Anthony D. Falk. South Texas Natives, Caesar Kleberg Wildlife Research Institute, Kingsville.
Forrest S. Smith. South Texas Natives, Caesar Kleberg Wildlife Research Institute, Kingsville.

Old World bluestem grasses (OWBs, e.g., Bothriochloa, Dichanthium spp.) have become dominant and altered native plant communities throughout the southern and central Great Plains, with concomitant effects for native fauna. We compared native plant and arthropod communities in areas dominated by native plants to areas dominated by OWBs (6 x 9-m plots, 5 each) at the Welder Wildlife Foundation Refuge in southern Texas. We sampled soils, vegetation, and arthropods every four weeks during summer 2011 and 2012. Soil pH was 2.07 (SE=0.14) units lower in native plant-dominated plots than OWB-dominated plots. Native plant-dominated plots had, on average, 2 (SE=0.17) more plant species, 12-13 (SE=1.00) more arthropod species, and 272.8 (SE=18.78) more arthropods per plot. Woodlice, springtails, and red imported fire ants were the dominant arthropods in native-plant dominated plots, whereas whirligig mites, wood roaches, and a native ant species were the dominant arthropods in OWB-dominated plots. We are modifying soil properties to try to restore native plant and arthropod communities, given these changes in species richness and abundance. We hope to provide insight for landowners to improve native species diversity and habitat quality for wildlife in grasslands impacted by OWB.

9:20-9:40
INTRODUCED NORTHERN PIKE PREDATION ON SALMONIDS IN SOUTHCENTRAL ALASKA
**Adam Sepulveda**. USGS Northern Rocky Mountain Science Center, Bozeman.
David Rutz. Alaska Department of Fish and Game, Palmer.
Krissy Dunker. Alaska Department of Fish and Game, Anchorage.

Abstract: Northern pike (*Esox lucius*) are opportunistic predators that can switch to alternative prey species after preferred prey have declined. This trophic adaptability allows invasive pike to have negative effects on aquatic foodwebs. In Southcentral Alaska, invasive pike are a substantial concern because they have spread to important spawning and rearing habitat for salmonids and are hypothesized to be responsible for recent salmonid declines. We described the relative importance of salmonids and other prey species to pike diets in the Deshka River and Alexander Creek in Southcentral Alaska. Salmonids were once abundant in both rivers, but they are now rare in Alexander Creek. In the Deshka River, we found that juvenile Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*) dominated pike diets and that small pike consumed more of these salmonids than large pike. In Alexander

Creek, pike diets reflected the distribution of spawning salmonids, which decrease with distance upstream. Although salmonids dominated pike diets in the lowest reach of the stream, Arctic lamprey (*Lampetra camtschatica*) and slimy sculpin (*Cottus cognatus*) dominated pike diets in the middle and upper reaches. In both rivers, pike density did not influence diet and pike consumed smaller prey items than predicted by their gape-width. Our data suggest that (1) juvenile salmonids are a dominant prey item for pike, (2) small pike are the primary consumers of juvenile salmonids, and (3) pike consume other native fish species when juvenile salmonids are less abundant. Implications of this trophic adaptability are that invasive pike can continue to increase while driving multiple species to low abundance.

**Coffee Break 9:40-10:10**

**Session 2: Land Management 10:10–10:50**

10:10-10:30

BIODIVERSITY, PRODUCTIVITY, AND LANDSCAPE CONSERVATION IN MONTANA: THE DISTRIBUTON OF PROTECTED AREAS AND HARVESTED FORESTS REVEAL PREFERENCES FOR RESOURCE USE AND WILDLAND PRESERVATION.

**R. Travis Belote.** The Wilderness Society, Bozeman.

Ecological patterns of biodiversity and productivity vary across landscapes. Patterns of human land use are influenced by these natural gradients, which determine concentrations of resource extraction and the location of wilderness preserves. I used various geodatabases to investigate how productivity and biodiversity were related to the locations of protected areas as well as the relative amount of forested area that has been harvested in Montana. Protected areas in Montana tended to be well represented in ecological regions of intermediate productivity and biodiversity, while the most productive ecoregions were more heavily used for timber harvesting. These highly productive and diverse regions have been preferentially targeted for timber extraction and contain higher densities of roads, which served as resource extraction infrastructure. While more heavily targeted for resource use, these productive regions may be more resilient to historical disturbance compared to less productive regions. These productive and heavily disturbed regions may be high priorities for holistic terrestrial and aquatic landscape restoration programs in the future. I will discuss these patterns in the context of ecological theory, public land stewardship and landscape conservation strategies.

10:30-10:50

MULTI-PARTY MONITORING OF FOREST TREATMENTS TO INFORM ADAPTIVE MANAGEMENT: DOES A COLLABORATIVE APPROACH WORK?

**Cory Davis.** University of Montana, Missoula.
Travis Belote. The Wilderness Society, Bozeman.

The Collaborative Forest Landscape Restoration Program (CFLRP) was established by the USDA in 2009 to provide a new model for public involvement in forest management on National Forest lands. One of the key requirements of the program was to require a multi-party monitoring program. The Southwestern Crown Collaborative CFLR project has developed a monitoring program involving the Forest Service, the University of Montana, and multiple local and national non-profit organizations. The program monitors the effects of treatments on wildlife, aquatic systems, vegetation and fuels, and local socioeconomics. We will present a brief overview of the monitoring program, some challenges of the multi-party approach, and a description of an experimental design being implemented by the Collaborative that other investigators may be interested in joining. The experimental approach will include multiple, replicated treatments and controls across several local Forest Service districts within a mixed-severity fire regime.

**Session 3: Avian Occupancy and Life history 10:50-11:30**

10:50-11:10

OCCUPANCY DYNAMICS OF AVIAN SPECIES IN RELATION TO A MOUNTAIN PINE BEETLE EPIDEMIC

**Victoria A. Saab.** USDA Forest Service, Rocky Mountain Research Station, Bozeman.
Brittany Mosher. Department of Ecology, Montana State University. Bozeman.
Michael Lerch. Department of Mathematical Sciences, Montana State University. Bozeman.
Jay Rotella. Department of Ecology, Montana State University. Bozeman.
Megan Higgs. Department of Mathematical Sciences, Montana State University. Bozeman.

Recent epidemics of mountain pine beetles (*Dendroctonus ponderosae*) will fundamentally alter Rocky Mountain forests, impacting management decisions related to fire, logging, and wildlife habitat. We evaluated effects of a recent mountain pine beetle epidemic on occupancy dynamics of 46 avian species. Seventy-six point count stations were randomly located in four, 250 ha study units within pine (*Pinus* spp.) forests in the Elkhorn Mountains, Montana. Each point was visited 3 times during the breeding seasons (May-July) 2003-06 (pre-outbreak) and 2009-11 (post-outbreak). We used a Bayesian hierarchical model of multi-species occupancy that accounts for imperfect detection and allows for estimates of rare, as well as common species. Occupancy was modeled for all species with respect to pre-outbreak years, year since the outbreak, and proportion of ponderosa pine. Results supported our prediction that occupancy rates would increase after the outbreak for bark-drilling woodpeckers (*Picoides* spp.). Whereas occupancy rates of foliage-gleaning chickadees (*Poecile* spp.) and bark-gleaning nuthatches (*Sitta* spp.) declined as expected soon after the outbreak peak, their rates began to rise within 3 years. Bark-gleaning species' occupancy relationships with ponderosa pine changed after the outbreak. Our results will help inform forest management activities for the persistence of species that evolved with large-scale disturbances.

11:10-11:30

A SUPRISING MOVE FOR HARLEQUINS

**Warren Hansen.** University of Montana, Missoula.
Dan Savage. Big Sky Animal Clinic, Kalispell.
Lisa Bate. Glacier National Park, West Glacier.
Creagh Breuner. University of Montana, Missoula.

Of the arctic and subarctic ducks, the harlequin is unique in its choice to breed on fast moving high elevation streams. Because of the dispersed nature of breeding pairs (often 1 pair per 2-3 km) and the cryptic nature of their nests, little has been published on the breeding ecology beyond observational studies. We used radio transmitters to follow the population of harlequins breeding on Upper McDonald Creek in Glacier National Park over the 2011 and 2012 breeding seasons. During the day, pairs and lone females were localized to specific regions of the stream, with moderate overlap between territories. However, both males and females left these territories at night. To evaluate this behavior, we placed an automated receiver unit at the north end of the lake, recording presence/absence for each individual in the study every 3-4 minutes. Individuals departed from their stream territories and flew up to 18 km to Lake McDonald for the night, arriving within approximately 30 minutes of sunset, and departing within 30 minutes of sunrise. It appears that this behavior continues until a female lays eggs, and resumes if her nest fails. To our knowledge, this is the first demonstration of this surprising behavior in harlequins.

**Lunch Break 11:30-12:30**

**Science and Natural History Film Program Film Screening 12:30-1:30**
Films will include:
RESTORING AN AMERICAN ICON – Bison conservation
WHITEOUT – Whitenose syndrome in bats
RARITY TO RECOVERY: THE STORY OF THE ANTIGUAN RACER SNAKE – A conservation success story
VOICES OF YELLOWSTONE – Sound pollution in Yellowstone National Park
CHASING BIRDS IN BERINGIA – Adventurous fieldwork on tundra swans!

**Session 4: Climate Change and Phenology 1:30-2:30**
1:30-1:50
LARGE LANDSCAPE CLIMATE CHANGE ADAPTATION IN THE NORTHERN U.S. ROCKIES AND AROUND THE GLOBE
**Molly S. Cross.** Wildlife Conservation Society, Bozeman.
Jodi A. Hilty. Wildlife Conservation Society, Bozeman.
Charles C. Chester. Brandeis University, Waltham, and Tufts University, Medford.

It is widely recognized that the current system of protected areas is inadequate to safeguard biodiversity from the threat of climate change. Conservationists have therefore argued for more integrated conservation across large landscapes and seascapes. We reviewed nineteen case studies from around the globe, including the Yellowstone-to-Yukon region, to assess how climate change is being incorporated into landscape and seascape science, planning, and action. We found both similarities and differences in the approaches taken and progress made, based on local ecological, political, and socio-economic circumstances. In regions experiencing high poverty, a lack of science is a major stumbling block, and solutions focus on sustaining both natural systems and human livelihoods. Changing water regimes is stressed in both freshwater and marine systems, where adaptive management is a key tool for managing under uncertainty. In montane systems, working across political boundaries is a challenge, and broad stakeholder buy-in has been important to advancing adaptation. In polar systems, increasing access to the region is altering the footprint of human activities, and adaptation efforts focus on finding refugia and managing transformative change. These case studies represent an ongoing set of experiments as to how to conserve biodiversity during this time of rapid climate change.

1:50-2:10
BIOPHYSICAL CONTROLS ON GRASSLAND PHENOLOGY IN THE UPPER YELLOWSTONE RIVER BASIN AND IMPLICATIONS FOR CONSERVATION UNDER CLIMATE CHANGE
**Nathan B. Piekielek.** Ecology Department, Montana State University, Bozeman.
Andrew J Hansen. Ecology Department, Montana State University, Bozeman.

Climate change (CC) may compromise our ability to maintain biodiversity within parks and anticipating future conservation challenges is currently a primary focus of scientists and managers. Grass and shrublands (hereafter grasslands) of Northern Yellowstone National Park and surrounding private lands provide key habitat for some of the last long-distance terrestrial migrants (ungulates) left in North America. The timing and landscape pattern of grassland growth and senescence (i.e. phenology) is thought to be a response to biophysical setting including climate and plays a prominent role in the long-distance movements of many ungulate species. However, little is known about the dimensions of climate that most strongly influence phenology at landscape scales and therefore how future changes in climate will likely affect patterns of grassland habitat. Recently developed land surface phenology (LSP) data and methods now provide powerful tools for understanding vegetation phenological response to climate. We apply LSP and statistical methods to identify the primary climate correlates and likely drivers of grassland phenology. These results help to anticipate CC effects on grassland phenology in the Greater Yellowstone Ecosystem and the conservation challenges that future change may present.

2:10-2:30
MODELS OF ARMY CUTWORM MOTH AND GRIZZLY BEAR HABITAT IN THE GREATER YELLOWSTONE ECOSYSTEM AND INVESTIGATIONS OF PHENOLOGY USING REMOTELY SENSED DATA

**Hillary L. Robison.** Program in Ecology, University of Nevada, Reno.
Peter F. Brussard. Program in Ecology, Evolution, and Conservation Biology, University of Nevada, Reno.
Charles C. Schwartz. U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman.

Army cutworm moths (*Euxoa auxiliaris*) are an important food for grizzly bears (*Ursus arctos horribilis*) in the Greater Yellowstone Ecosystem (GYE). The moths migrate from low elevations in the Great Plains and Intermountain West to high elevations in the GYE where they aggregate in talus and are consumed in the millions by bears from July through September. Moths are the only major bear food in the GYE for which there is no direct method to monitor its availability to bears. Moth sites are scattered in wilderness and no model exists to predict where additional sites may occur. In years when deep snow accumulates the moths' habitat may remain covered in snow and be unsuitable. We modeled moth and bear habitat and modeled phenology (i.e., green-up) at these sites to inform monitoring and management. We used logistic regression to model the characteristics of sites used by moths and bears ($n$ = 301) and of available sites ($n$ = 1000). We considered 18 variables in four different models and refined the models using AIC. We evaluated models and mapped the best model using ArcGIS. To investigate green-up we analyzed climate data and remotely-sensed AVHRR data using ERDAS Imagine, ArcGIS, and multiple linear regression. The best habitat model showed that elevation, geology, and wetness from Landsat imagery describe areas moths and bears use and predict areas bears may search for moths (AUC = 0.87). The best phenology model predicted green-up with respect to biweekly mean temperature and precipitation, and the results ($R^2$ = 0.53) were on par with other similarly-scaled studies.

**Coffee Break 2:30-3:00**

**Session 5: Restoration 3:00-4:00**

3:00-3:20
COLLABORITIVE EFFORTS ON BEHALF OF INTERIOR CUTTHROAT TROUT (*Oncorhynchus clarki*): A PRIVATE INITIATIVE TO CATALYZE NATIVE TROUT RESTORATION IN 250 MILES OF HABITAT

**Carter Kruse.** Turner Enterprises, Inc, Bozeman.
Pat Clancey. Montana Fish, Wildlife and Parks, Ennis and Helena.
Kirk Patten. NM Department of Game and Fish, Santa Fe.
Brad Shepard. Wildlife Conservation Society, Bozeman.

The Turner organization is guided by a philosophy of conserving and restoring biological diversity within an economically sustainable land management framework. While we emphasize the role private lands must play in native species conservation, relationships and collaboration with public agencies are critical. Interior cutthroat trout have been a focal conservation species on Turner lands, and collaboration between the Turner organization and state and federal resource management agencies has led to the implementation of two of the largest stream restoration projects ever attempted. These projects – Cherry Creek in Montana and Costilla Creek in New Mexico – are the foundation of a goal to catalyze conservation or preservation of cutthroat trout in 250 miles of habitat. This presentation will discuss our progress toward reaching this goal, as well as provide some initial insights regarding novel conservation research being conducted alongside restoration. Research efforts underway include: understanding the impacts of cutthroat trout restoration on non-target organisms; the best genetic sources of founding individuals; the temporal scale of population recovery; and how new populations use novel and open habitat. We believe the experiences learned during project implementation and information gained from research will provide important contributions to aquatic conservation efforts in the future.

3:20-3:40
RESTORATION OF WESTSLOPE CUTTHROAT TROUT INTO 100KM OF CHERRY CREEK, A MADISON RIVER TRIBUTARY.
**Bradley B. Shepard.** Wildlife Conservation Society and Montana State University, Bozeman**.**
Carter Kruse. Turner Enterprises, Inc., Bozeman.
Pat Clancey and Lee Nelson. Montana Fish, Wildlife and Parks, Ennis and Helena.
Tessa Andrews, Dan Drinan, and Steven Kalinowski. Ecology Department, Montana State University. Bozeman.
Alexander Zale. USGS Montana Cooperative Fishery Research Unit. Bozeman.
Scott Barndt and Bruce Roberts. Gallatin National Forest. Bozeman.

A 7 m waterfall on lower Cherry Creek located about 13 km above its junction with the Madison River isolates about 100 km of potential fish habitat from invasion by non-native fish. A collaborative group of managers and researchers took advantage of this feature to restore native westslope cutthroat trout to the upper basin above this waterfall over a period of about 15 years by removing non-native trout that occupied this area using piscicides and releasing westslope cutthroat trout embryos. This project was a complex, long-term restoration project implemented by state and federal agencies, a private landowner, NGO partners, and university researchers. Research was designed into the planning phase of this project and is providing valuable information that can be used to inform other similar restoration efforts and answer species conservation questions. Collaboration allowed partners to complete the project in spite of administrative and legal challenges, mistakes made by each major partner, and the duration and complexity of the project. Preliminary research results indicate that each cutthroat trout donor stock used to start the new population has contributed, but differences in incubation success and behavior were observed.

3:40-4:00
USING POPULATION ECOLOGY TO PLAN THE RESTORATION OF BOLSON TORTOISES (*GOPHERUS FLAVOMARGINATUS*) TO THEIR PLEISTOCENE RANGE IN THE U.S.
**Magnus McCaffery.** Turner Endangered Species Fund, Bozeman.
Mike Phillips. Turner Endangered Species Fund, Bozeman.

The last wild bolson tortoise (*Gopherus flavomarginatus*) population is at risk of extinction in Mexico due to anthropogenic pressures and climate change. Through a bolson tortoise captive program in New Mexico, we have achieved high annual survival and reproductive rates, and increased our captive population size by over 500% since 2006. We are using population modeling to inform future reintroductions of this species to its Pleistocene range in New Mexico. We constructed post-birth pulse stage-structured matrix models for captive and reintroduced populations. We examined the relative impacts of different release scenarios on both wild and captive population growth rates, where the number and stage class of released individuals varied. Results from this approach indicate that we will have a sufficient number of releasable individuals to commence reintroductions in 2015, and that staggering the release of multiple age groups on an annual basis will facilitate relatively rapid growth of the wild population while maintaining a productive captive population for annual wild augmentation. We show how efforts to reintroduce endangered species can be guided by population tools, particularly when a balance must be struck between maintaining a productive source population and optimizing reintroduced population growth rates.

**Dinner Break 4:00-6:30**

**Plenary Lecture 6:30-7:30**

SPILLOVER: ANIMAL INFECTIONS AND THE NEXT HUMAN PANDEMIC

**David Quammen**. Author, Bozeman.

David Quammen will speak about his new book, *Spillover*, where he combines science reporting, history, and adventuresome travel to examine zoonotic diseases, the infections that can leap to humans from other species.

**Poster Session and Beer/wine Reception 7:30-9:30**

**POSTERS:**

1. SPATIAL PATTERNS OF PAST AND PRESENT CLIMATE CHANGE IN THE GREATER YELLOWSTONE AREA

**Tony Chang**. Department of Ecology, Montana State University, Bozeman.
Andrew Hansen. Department of Ecology, Montana State University, Bozeman.
David Toma. Northern Colorado Plateau Network, NPS Inventory and Monitoring Program, Bozeman.

As land resource managers and scientists are growing more concerned with climate change effects on ecosystems across the landscape, identifying specific regions of climate spatial trends are becoming necessary to allow for greater precision and efficiency of resources in management actions and research. The growing availability of regional down-scaled climate dataset interpolations at high spatial resolutions have allowed for fine grain statistical analysis. These analyses may reveal that spatial trends in climate factor gradients that are not ubiquitous throughout the landscape and that climate changes are heterogeneous. This analysis uses the PRISM (4kmx4km) climate dataset to explore the rates of change for climate factors Tmax and Tmin within the time period of 1895-2011 at the individual spatial grain level, to develop a summarization of climate changes within the Greater Yellowstone Ecosystem. The results of this analysis observe greatest magnitude of change in the Tmin factor in the higher elevation regions over the past ~100 years and observe lower magnitudes of change occurring in both Tmax and Tmin within the lower elevation regions. These finding suggest that sub-alpine/alpine ecosystems have been and may continue to be the regions being impacted the most by changing climate and should be focal regions for resource managers, stakeholders, and scientists.

2. USE OF REPHOTOGRAPHY TO UNDERSTAND THE EFFECTS OF HISTORICAL EXTRACTION OF NATURAL RESOURCES ON RIVERS OF THE GREATER YELLOWSTONE REGION

**Heidi Clark** and Dr. Duncan Patten, Land Resources and Environmental Sciences, Montana State University, Bozeman.

Repeat photographs provide a glimpse of the past and thus tell a story of how time has shaped the landscape. Rivers are dynamic and constantly changing course; the same river can appear differently depending on the season and year. It can be difficult to judge the dramatic changes that take place over a century. With the use of repeat photography, this study will show how headwater rivers of the Greater Yellowstone Region have been affected by extractive influences (e.g., logging, mining, and dam building) over the last one hundred years. These rivers include the Gallatin, Madison, Snake, Henry's Fork of the Snake River, Yellowstone, Clark's Fork of the Yellowstone, Shoshone, Wind, and Green Rivers. Through a comparison of historic and recent photos, this study will examine whether the rivers affected by extractive resources are resilient enough to maintain ecological function through both qualitative and qualitative dimensional analysis. This research on riverine processes over time, documented by rephotography, will greatly increase the understanding of recovery and resiliency of natural systems when affected by disturbance and thus aid future riverine restoration work in the Northern Rocky Mountains.

3. CHANGES IN NEST DENSITY AND DAILY NEST SURVIVAL OF TWO WOODPECKER SPECIES IN RELATION TO A MOUNTAIN PINE BEETLE EPIDEMIC

**Matthew A. Dresser**. Department of Ecology, Montana State University, Bozeman.
Victoria A. Saab. USDA Forest Service, Rocky Mountain Research Station, Bozeman.
Jay Rotella. Department of Ecology, Montana State University, Bozeman.
Quresh Latif. USDA Forest Service, Rocky Mountain Research Station, Bozeman.

The Mountain pine beetle (*Dendrotonus ponderosae*) is a bark beetle native to western North America capable of large-scale population eruptions, resulting in high tree (*Pinus* spp.) mortality that alters resource availability to wildlife, particularly snag-associated species. Many woodpecker species rely on conifer snags for nesting and foraging substrate. We studied nesting survival and densities of woodpeckers in relation to a recent mountain pine beetle outbreak in western Montana. Because of life history differences among woodpeckers, we expected that densities and survival of American three-toed woodpecker (*Picoides dorsalis*) would increase, whereas we predicted no changes for red-naped sapsucker (*Sphyrapicus nuchalis*). American three-toed woodpecker is a bark-drilling specialist that feeds on beetle larvae and frequently nests in conifer snags, whereas red-naped sapsucker specializes on consuming sap of live trees and rarely nests in conifer snags. Results supported our predictions about three-toed woodpecker (period nest survival pre= 0.58 ± 0.18 vs. post= 0.78 ± 0.11). While no changes were detected in red-naped sapsucker nest survival (pre= 0.73 ± 0.06 vs. post= 0.78 ± 0.07), unexpectedly their densities increased after the beetle outbreak. Our results will inform management activities for post-beetle forests that will help maintain habitat of disturbance specialist species.

4. LIFESPANS OF FUEL-REDUCTION PROJECTS IN FORESTS OF THE CROWN OF THE CONTINENT, MONTANA: HOW LONG CAN WE EXPECT TODAY'S INVESTMENTS TO BE EFFECTIVE AT REDUCING FIRE RISK?

Danielle LaPlant. Hopa Mountain Native Science Fellow, College of Forestry and Conservation, University of Montana, Missoula.
**R. Travis Belote**. The Wilderness Society, Bozeman.
Cara R. Nelson. College of Forestry and Conservation, University of Montana, Bozeman.

Residential development in fire-adapted forests results in homes and property at risk of burning in wildfires. To reduce fire risks, billions of dollars have been spent on fuel-reduction projects throughout the Intermountain West. However, while fuels may be effectively reduced in the short term, in the years following treatment application, forest density and fuel loadings are expected to increase so that treated areas will no longer reduce fire hazard. However, the number of years that fuel-reduction treatments actually reduce the risk of crown fires is mostly unknown, despite numerous calls for research investigating "lifespans" of treatments. We conducted modeling experiments using the Forest Vegetation Simulator to predict trends in crowning index (CI) for 100 years following mechanical thinning and prescribed fire among various forest types. We calculated the lifespan of treatments as the number of years that CI indicated reduced crown fire risk relative to pre-treatment CI. Results suggest that thinning decreased crown-fire risk, and the effect lasted ~20 to 80 years depending on the type of forest and whether prescribed fire was used in conjunction with mechanical treatments. Understanding the lifespans of fuel-reduction treatments should inform collaborative project planning so that future costs to maintain fire-risk reduction are considered.

5. ASSESSING EFFECTS OF ELECTRICITY ON LARVAL *LITHOBATES CATESBEIANA* (AMERICAN BULLFROG) TO DEVELOP ELECTROFISHING MANAGEMENT GUIDELINES FOR SENSITIVE AND INVASIVE AMPHIBIAN SPECIES

**Megan J. Layhee**. U.S. Geological Survey, Bozeman.

Electrofishing is one of the most common monitoring tools in fisheries management; however, there is growing concern over the effects of these techniques on non-target species, specifically amphibians. In this study I generated pulsed-direct current (PDC) in a homogenous electrical field with a Smith-Root Portable Electroanesthesia System (PES™) and individually exposed bullfrog larvae (Gosner stage 26-44) to a specific voltage gradient (V/cm) in order to test the lethality of electrical parameters commonly used with backpack electrofishing equipment. I also assessed how various water conductivities play a role in the lethality of electricity. I found a significant difference in mean mortality rates in larvae exposed to varying voltage gradients ($F$ (4, 40) = 8.53, $p$ = 0.00) including 0.0% mortality for larvae exposed to low voltages (0.0-10.0 V/cm), and 50.0± % mortality for larvae exposed to 26.7 V/cm. I also found low mortality rates across a range of water conductivities (88.0-1,198.0 µS/cm) at a constant voltage gradient (16.7 V/cm). Results of this work demonstrate the negative effects of increased voltage on bullfrog larvae. Since little information exists on the impacts of electrofishing to amphibians, this research may aide in understanding the impacts of fisheries management tools to sensitive species and demonstrates the applicability of electrofishing to control invasive bullfrog populations.

6. COMMUNITY-WIDE IMPACTS OF AQUATIC INVASIVE SPECIES AND LAND USE IN HAWAIIAN STREAMS

**Megan J. Layhee**. California State University, Chico.
Michael P. Marchetti. California State University, Chico, St. Mary's College of California, Moraga.
Sudeep Chandra. University of Nevada Reno, Reno.
Tag Engstrom. California State University, Chico.
Daniel Pickard. California Department of Fish and Game, Chico.

In Hawai'i's stream communities, aquatic invaders are altering trophic interactions and human infringement is related to degrading habitat; together these stressors may be leading to the decline of native stream species and facilitation of more tolerant exotic species. In this study we employed $\delta^{13}C$ and $\delta^{15}N$ isotopes to examine the structure of several Hawaiian stream food webs with varying levels of these stressors and to illustrate interactions between native and invasive organisms that may represent drivers of community change. Over a 2-year period we sampled 40 consumer species in four streams and found increased species richness and trophic diversity in disturbed sites. We also found 30 potential incidences of competitive interactions between native and non-native consumers, and, in three of the four streams we found non-native predatory species inhabiting top trophic positions. Lastly, we observed that native stream consumers are nearly absent in one stream community containing over 15 non-native consumers and apparent habitat degradation. To our knowledge this study is the first to demonstrate the effects of disturbance on stream food webs in Hawai'i using stable isotopes, and our results suggest significant trophic changes have occurred as the result of these forces.

7. DOES TERMINATING A COVER CROP WITH SHEEP GRAZING CHANGE PLANT COMMUNITY STRUCTURE?

**Sean McKenzie**. Land Resources and Environmental Sciences, Montana State University, Bozeman.
Hayes Goosey. Animal and Range Sciences, Montana State University, Bozeman.
Kevin O'Neill. Land Resources and Environmental Sciences, Montana State University, Bozeman.
Fabian Menalled. Land Resources and Environmental Sciences, Montana State University, Bozeman.

Targeted sheep grazing of cover crops could potentially benefit agriculture as it may provide farmers an alternative to using machinery while enhancing nutrient cycling, soil conservation, and pest management. Because grazing represents an ecological filter of plant communities, it is important to understand its potential impacts on weed community structure before implementation on agroecosystems. We compared the effects of sheep grazing and mowing for cover crop termination on plant community structure at Towne's Harvest Organic Farm in Bozeman, MT. Metrics included plant diversity, weed biomass, and cover crop biomass. In six 10 m X 15 m plots, we seeded a cover crop consisting of buckwheat

(*Fagopyrum esculentum* Moench), beet (*Beta vulgaris* L.), sweetclover [*Melilotus officianalis* (L.) Lam.], and pea (*Pisum sativum* L.), allowed it to grow to peak biomass, collected samples at peak biomass, and terminated half of the plots with sheep grazing and half with tractor mowing. We collected similar measurements one month after terminating the cover crop. We failed to detect any significant difference in plant biomass and diversity between mowed and grazed plots both prior to and after cover crop termination. Our results suggest that farmers integrating sheep grazing may not encounter deleterious changes in weed communities.

8. YELLOWSTONE NATIONAL PARK AND THE ORIGINS OF CONSERVATION BIOLOGY
**Diane Smith**, Independent Scholar, Missoula.

On June 23-26, 1987, the Society of Conservation Biology held its first annual meeting at Montana State University where members would be "close to Yellowstone and Glacier national parks. Bison, wolves, grizzlies, trumpeter swans, extensive wilderness areas, and black-footed ferret habitat are all within a few hours' drive." In its commitment to saving endangered species and habitat, the new group believed that "they were boldly going where no one had gone before." And yet, many had indeed gone before, starting in the same region in which the Society held its first meeting 25 years ago. Through a special relationship established in the late 19th century with the Smithsonian and the National Zoo, Yellowstone National Park contributed to programs of captive breeding and display, and participated in "artificial transfers" (i.e., animal shipments and exchanges). The U.S. Cavalry fenced the northern boundary near Gardiner to keep antelope and other animals in, and shipped antelope, beaver, elk, and eventually bison to other reserves and parks around the country. Yellowstone even purchased bison from Montana and Texas to establish their own program of captive breeding and display. In essence, Yellowstone functioned as one of the nation's first centers of conservation biology.

## FRIDAY, OCTOBER 26TH – MUSEUM OF THE ROCKIES CLASSROOM:

**Registration and Breakfast 7:30-8:30**

**Session 6: Incorporating Citizens into Conservation 8:30-9:10**
8:30-8:50
CITIZEN SCIENCE AND PIKAS: DEVELOPING A DISTIBUTIONAL DATABASE FOR THE FUTURE
**April Craighead.** Craighead Institute, Bozeman.

Citizen science has a long history of providing quality data to researchers and agency personnel to determine population trends and species richness for a variety of organisms. The American pika (*Ochotona princeps*) is an ideal species to incorporate into a citizen science program, they are charismatic, easy to identify and are found in spectacular settings. While pikas are found throughout the western United States, little is known about their actual distribution. Pikas are also an important indicator species for climate change and it was recently considered for endangered species protection due to marked population declines in portions of its range. In 2010, I began the Montana pika survey to enlist agency personnel and citizen scientists to record pika locations throughout the state. I conducted numerous public presentations, training sessions and outreach to volunteers on pikas and the importance of alpine ecosystems. Since its inception, the survey has recorded approximately 100 new pika locations statewide which will be used by agencies and researchers throughout Montana. Developing a pika database will provide wildlife managers current information on pika distribution and areas of refugia that pikas will be able to utilize as the climate changes.

8:50-9:10
HOW CONSERVATION BIOLOGISTS CAN BENEFIT FROM THE USE OF ADVENTURE ATHLETE VOLUNTEERS TO COLLECT DATA FROM AROUND MONTANA AND THE WORLD
**Gregg Treinish.** Adventurers and Scientists for Conservation, Bozeman.

Gregg Treinish is the Founder and Executive Director of Adventurers and Scientists for Conservation (ASC). ASC works to improve the accessibility of scientific knowledge through partnerships between adventure athletes and scientists. Data collection in remote areas can be expensive, time-consuming, and physically challenging. By utilizing the unique skills of some of the world's best polar explorers, mountaineers, climbers, skiers, kayakers, and divers, as well as ordinary outdoor enthusiasts, ASC provides the science community with a means to effectively gather otherwise inaccessible data at a fraction of the cost. Gregg will be speaking about the history of ASC, its citizen-science projects, several recent successes including collection of the highest known plant life on Earth from Mt. Everest, and how to get involved and begin working with volunteers already traveling to the world's most remote locations. Gregg is a 2008 National Geographic Adventurer of the Year and was recently named to the Christian Science Monitor's 30 under 30 list. Both he and ASC have been featured in Science News, Science Magazine, Outside Magazine, National Geographic Adventure, Audubon, the New York Times, and many more.

**Session 7: Corridors, Connectivity, and Large Mammal Ecology 9:10-10:30**

9:10-9:30
HOW WELL CAN WE PREDICT WILDLIFE CORRIDORS? VALIDATING CONNECTIVITY MODELS WITH GPS DATA FROM MIGRATING ELK AND DISPERSING WOLVERINES
**Meredith Rainey.** Montana State University, Bozeman.
Andrew Hansen. Montana State University, Bozeman

Landscape connectivity has become a key focus of conservation biology as natural habitat is increasingly fragmented by human land use. Several approaches to modeling landscape connectivity are now frequently relied upon to identify probable dispersal and migration corridors and guide conservation planning. However, the predictive accuracy of these methods has seen limited testing against empirical movement data, which limits confidence in their utility and confuses selection of appropriate methods for a given application. To address these issues, I used GPS collar data from migrating elk and dispersing wolverines to evaluate the ability of common modeling approaches (least-cost corridor models and circuit theory models) to predict observed movement paths. Relative performance of the two models differed between elk and wolverines, with important implications for model compatibility with focal species movement ecology. Furthermore, the form and complexity of underlying landscape resistance maps influenced model performance and revealed unforeseen differences between connectivity modeling approaches. These findings illustrate that connectivity model performance depends greatly on focal species ecology an as well as selection of appropriate methods for the application at hand.

9:30-9:50
DEMOGRAPHIC CONNECTIVITY FOR URSID POPULATIONS AT WILDLIFE CROSSING STRUCTURES IN BANFF NATIONAL PARK
**Michael A. Sawaya.** Western Transportation Institute, Montana State University, Bozeman.
Anthony P. Clevenger. Western Transportation Institute, Montana State University, Bozeman.
Steven T. Kalinowski. Ecology Department, Montana State University, Bozeman.

Wildlife crossing structures are one solution to mitigating the fragmentation of wildlife populations caused by roads, but their ability to provide demographic connectivity has only been superficially evaluated. We conducted a three-year investigation to determine how crossing structures provide connectivity for grizzly (*Ursus arctos)* and black bears (*U. americanus)* in the Bow Valley of Banff National Park, Alberta. We used multiple noninvasive hair collection methods to sample bear populations

near the Trans-Canada Highway. Our main objectives were to: 1) determine the number of male and female grizzly and black bears using crossings structures, 2) examine the spatial and temporal patterns of use, and 3) estimate the proportions of grizzly and black bear populations using crossings. We identified 15 grizzly (7 F, 8 M) and 17 black bears (8 F, 9 M) using crossing structures. Grizzlies showed strong preference for open crossing structure types (e.g., overpasses). Peak use for both bear species occurred in July when high rates of foraging activity coincide with mating season. We detected considerable proportions of grizzly (15.1% in 2006; 19.7% in 2008) and black bear (18.5% in 2006; 10.6% in 2008) populations using crossings. We conclude that wildlife crossing structures provide demographic connectivity for ursid populations.

9:50-10:10
FAILING TO SUCCEED: MOOSE AND ELK ROAD CROSSINGS
**Nicholas Sharp**. Wildlife Conservation Society and University of Montana, Missoula.

Wildlife-vehicle collisions (WVCs) pose a substantial risk to human safety and a major threat to wildlife. Numerous studies of WVCs identified road or landscape characteristics that correlate with locations animals died, with traffic volume and vehicle speed being the most often implicated factors. Other studies investigated locations animals crossed roads, most often linked to preferred habitat. A few studies show crossing locations are not necessarily the same as death locations. Can we identify locations ungulates cross roads successfully? Using track surveys to identify crossing locations and roadkill data to identify death locations, I used Resource Selections Functions to calculate the probability of crossing and the probability of death for moose and elk in relation to road and traffic variables. Model selection showed speed and sight distance were important predictors of crossing locations while traffic volume, distance to secondary road, and number of traffic lanes were important predictors of death locations. Results indicate it may be important to consider factors determining where animals choose to cross the road, in addition to factors contributing to WVCs, when deciding where to situate WVC mitigation measures. Identifying factors that contribute to a successful road crossing may improve the design of road crossings for wildlife.

10:10-10:30
ELK CALF RECRUITMENT AND POPULATION DYNAMICS IN THE GREATER YELLOWSTONE ECOSYSTEM: NEW DRIVERS AND NEW DYNAMICS.
**Scott Creel**. Ecology Department, Montana State University, Bozeman.

Recently, the population dynamics of elk have changed markedly in some Montana and Wyoming regions, while population dynamics have changed little in other regions. Calf recruitment is widely held to be an important driver of elk dynamics, and in most areas with reduced population growth, pregnancy rates and recruitment have declined. These changes coincide with wolf recovery in the region, but the causes are debated. Here, we tabulated and analyzed data for 12 elk populations -- six within the region colonized by wolves, and six outside the wolf recovery area. The data span a period of 30 years before and after wolf recolonization, allowing a before-after-control-impact analysis (with some important limitations). We examined changes in population size and calf recruitment, and tested for relationships with all of the variables that have been hypothesized to affect elk dynamics. These include changes in density, winter snow accumulation, growing season conditions, human harvest, predation by bears, direct predation by wolves, and the 'risk effects' of wolf presence. Some of these variables were strongly correlated with recent changes in elk dynamics, while others were not.

**Field trip to Ted Turner's Flying D Ranch 11:00-3:00 (lunch included)**
Depart from the Museum of the Rockies parking lot.