partial cambial dieback, which may be directly related to their rapid growth rates. There remains a controversy pertaining to the geographical extent of this phenomenon and its physiological interpretation. The objectives of my research were to: Determine if white bark pine trees at upper tree line in the Tobacco Root Mountains exhibit anomalous growth rates during the 20th century. Assess the evidence for $C0_2$ fertilization as a cause of differential growth rates. My results will speak to the issue of whether increased atmospheric $C0_2$ concentrations during the 20th century has significantly altered tree growth, and thus serves as one of the first indications of the impacts of global change on terrestrial ecosystems.

BIOLOGICAL SCIENCES - TERRESTRIAL

QUANTITATIVE MOTION ANALYSIS AND SPATIAL DYNAMICS OF SNOWSHOE HARES IN DIFFERENT HABITAT TYPES [TWS]

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Snowshoe hares (*Lepus americanus*) are the primary prey of a threatened carnivore—the Canada lynx (*Lynx Canadensis*). A pressing management question in lynx conservation is how snowshoe hares respond to the pre-commercial thinning occurring across the northern U.S. I studied this habitat issue using quantitative motion analysis. Primary movement data provides a window into an animal's relationship with its landscape, and its behavior with detail. During winters from 1999-2001, I back-tracked radio-collared hares across snow on four forest thinning treatments in Northwestern Montana. I measured turning angles every 5 m for up to 70 m of path, distance and direction to shelter at each point, described habitat conditions and noted the behavior of the hare as evidenced by the tracks. I quantified the tortuosity (lack of directional bias) of hare paths in each of the forest treatment types. I also elicited realistic predator-avoidance behavior using a domestic dog to flush the hares. Baseline data indicate that hares in areas with high secondary growth exhibit higher tortuosity compared to the relatively "straight line" movements of hares in open areas. Interestingly, hares in open canopy young forest regularly move like hares flushed by a predator in closed cover. Thus, movements may reflect fitness consequences.

WINTER, SUMMER, DIURNAL, AND NOCTURNAL HOME RANGES OF SNOWSHOE HARES IN WESTERN MONTANA [TWS]

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Snowshoe hare (*Lepus americanus*) home range is an important parameter in mark-recapture density estimation, and could affect interactions between hares and the Canada lynx (*Lynx canadensis*). We estimated winter and summer snowshoe hare home range size in

Western Montana. We relocated adult radio-collared hares in winter (n = 6) and summer (n = 11) at all hours, and estimated home range area using a fixed kernel estimator. Male home range area in summer was larger than winter home range, while female summer home range was comparable to winter home range. Estimated hare utilization distributions (u.d) in summer were larger than reported in previous studies; mean summer 95 percent u.d. home range was 23.9 ha for males and 10.7 for females. Three female and four male hares had estimated 95 percent u.d. home ranges larger than 13 ha in summer. Average summer daytime 75 percent u.d. home range size was 3.31 ha smaller across all hares than summer nighttime home range. In the summer, females appeared to have a larger nocturnal home range relative to their total home range than did males. Hares with core areas of their home ranges within mature forest stands with complex vegetation structure generally had larger overall home ranges.

Update on Mountain Lion Research in the Garnet Mountains [TWS]

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Mountain lion research began in the Garnet Mountains in 1998 to better understand characteristics of a hunted lion population and evaluate the accuracy of track surveys and other techniques to monitor trends in lion abundance. The 330 square mile study area located south of Ovando represents typical hunted mountain lion habitat of central and western Montana. Fifty-one mountain lions have been equipped with transmitters and research to date indicates that lion biology and ecology are similar to other studied lion populations. Hunting resulted in 14 of 21 radioed adult lions harvested during 1998 and 1999. Lion hunting was suspended for 3 years starting in 2000 in order to capture all lions in the study area and to allow the population to increase. After a 3-year increase, hunting will again be allowed, thus reducing the number of lions. By having the population increase and then decrease we can determine which population indicators are most sensitive to changes in lion abundance. Population indicators being evaluated include trends in the number of lion tracks on survey routes. Eleven routes (7-39 miles in length) have been established and were searched primarily by snowmobile 10 times this winter to document the number and location of lion tracks. These 170 miles of roads and trails will be inventoried during the 6-year period to determine the relationship between lion track density and the actual density of lions. Other population indicators being evaluated include lion observations by deer hunters sampled through FWP's statewide telephone survey; interviewing a portion of the state's houndsmen to record views on lion trends; lion hunting statistics; deer and elk trends in the study area; and lion DNA sampling.

Detecting Canada Lynx in Glacier National Park, Montana [TWS]

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Historic records of Canada lynx (*Lynx canadensis*) sightings and tracks in Glacier

National Park were summarized in 1994. A pilot snow-track survey for forest carnivores was also begun in 1994, and winter track surveys have been repeated annually since then, supplemented with a few remote camera stations. These surveys and anecdotal reports provided useful information on the distribution of lynx in the park, but little information on the status of the lynx population. Initial efforts to apply emerging detection techniques using DNA analysis of hair samples were undertaken during the late summer of 1999. A 100 mi^2 (259 km^2) area in the North Fork drainage, 86 percent in the park, was sampled using the protocol developed by John Weaver. No lynx were detected during this survey of a remote area with few previous lynx track records. During summer/fall 2000, we tested the USFS National Lynx Detection Protocol (NLDP) (KcKelvey et al. 1999) to 1) determine its effectiveness in the variety of habitats and topography that characterize the park, 2) assess the feasibility of conducting surveys with dense sympatric populations of grizzly bears and black bears, 3) obtain a minimum population estimate and additional information on lynx distribution, and 4) compare the systematic positioning of transects to a subjective approach to detection station placement. Using the NLDP, we established 87 transects with 433 stations in 3 study areas in Glacier National Park. This sampling effort yielded 76 hair samples: 8 lynx, 2 bobcat, 3 grizzly bear, 47 black bear, and other samples not yet identified to species. Five of the 6 lynx samples analyzed to individual to date were unique individuals. All lynx were detected in mixed conifer-aspen-meadow and treeline habitats; none were detected in the continuous coniferous forest habitats sampled. Twenty-nine percent of stations were disturbed (primarily by wind, bears, and/or elk), and at 13 percent of stations the visual lure was removed by the end of the sampling period. Twenty transects with 100 stations were placed subjectively in areas sampled with the NLDP. Three hair samples were collected from these stations, of which 2 were lynx – a comparable rate per station to the NLDP. These methods were successful in detecting lynx in areas where they were known to occur.

Understanding Relationships Between Sage-Grouse Habitat and Population Dynamics in Eastern Montana [TWS]

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The long-term decline of greater sage grouse (*Centrocercus urophasianus*) over much of their historic range is of concern to managers of sagebrush (*Artemisia* spp) habitats. A petition has been submitted to list the Washington population of sage grouse under the Endangered Species Act (ESA) and a range-wide listing petition is expected in the near future. That habitat quality is related to demographics of populations is a fundamental assumption of the practice of managing species via managing habitat. However, few studies explicitly acknowledge this relationship, and still fewer explicitly attempt to define this relationship on a species-specific basis. There currently is no way to reliably determine the nature of the interaction between sage grouse population status (as indicated by estimated vital rates) and habitat condition. This research will use a combination of well-established population demography tools and state-of-the-art analysis methods to elucidate relationships

between Sage-Grouse populations and habitat at 6 sites in eastern Montana. Mark-resight and radio telemetry methods will be employed to estimate vital rates of Sage-Grouse populations. Sensitivity analysis will identify which rate(s) has the greatest influence on population growth rate under different habitat conditions. Habitat condition at each site will be assessed by several crucial habitat characteristics. A regression approach will quantify the relationship between individual vital rates and each of the measured habitat characteristics. The research will provide crucial information to federal and state wildlife professionals charged with managing for sage grouse and will be of particular use in the event of a petition to list sage grouse under the ESA.

Evaluating Effective Group Release Size, Population Growth, and Survival Rate of Translocated Black-tailed Prairie Dogs on the Charles M. Russell National Wildlife Refuge, Montana [TWS]

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Black-tailed prairie dogs (*Cynomys ludovicianus*) are an integral component of prairie ecosystems, but in recent years their numbers have been reduced due to eradication programs, conversion of grassland to cropland, and the spread of sylvatic plague. In an effort to re-establish prairie dogs into plagued historic colony sites, translocation efforts began in 1997 on the Charles M. Russell National Wildlife Refuge (CMRNWR). Translocation experiments require several issues be determined: 1) Conditions needed for successful translocation such as stocking density; 2) Survival of translocated animals; and 3) Colony size. Stocking density was addressed by comparing group release sizes of 120 animals, 60 animals, and no animals (control) on three different size classes of remnant colonies, >5, 0.1-5, and 0 acres. Survival rates of translocated animals were ascertained using mark-recapture techniques. The numbers of translocated animals within the release area were calculated using visual counts, live-trapping techniques, and burrow densities. Prior to this study, the perimeters and burrow densities of each colony on the CMRNWR were mapped with a Global Positioning System and used as baseline data. Monitoring colony sizes and burrow densities provided important information necessary for determining changes due to recolonization, augmented and natural. From the information gathered, I determined the affects of augmentation.

Estimating Green Biomass of Big Sagebrush using Remote Sensing Techniques: Preliminary Results [TWS]

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An efficient method to estimate amounts of Big Sagebrush (*Artemisia tridentata*) would be helpful for assessing habitat for a wide range of species and determining change over time. Preliminary results from our work in sagebrush/grassland habitats of Yellowstone National Park and the Missouri Breaks indicate light reflectance from a portable radiometer can predict green biomass of big sagebrush (*Artemisia tridentata*) in addition to biomass of herbaceous vegetation. During 1999 and 2000, we took radiometer readings and dimension measurements of sagebrush plants in 0.75 m diameter plots prior to collecting all green portions of sagebrush plants. Individual bands of reflected light predicted green biomass ($R^2 = 0.68$) of sagebrush in 48 plots known to contain sagebrush. In itself, sampling with a portable radiometer could be used to quickly estimate green sage biomass over large areas. We are currently trying to apply our results to estimate sage biomass on a landscape scale using satellite imagery.

Nesting Habitat Selection and Productivity of Northern Goshawks in West-central Montana [TWS]

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During the 1997 and 1998 nesting periods, I systematically surveyed for Northern Goshawks (*Accipiter gentilis*) using a randomized design across all available forest cover types in the northern Flint Creek Range in west-central Montana. The study was done to obtain an unbiased estimate of nest-site selection, quantify nesting habitat at five spatial scales (landscape, post-fledging family area, nest stand, nest-tree area, and nest tree proper), and compare the success and productivity of goshawk nesting attempts among habitats selected by goshawks. Results suggested that in an intensively managed landscape, goshawks selected a core area of mature forest (15 ± 3.6 ha) that was surrounded by denser, smaller-sized trees. Logistic regression predicted goshawk presence based on the proportion of land within the post-fleding family area that contained north aspects, high canopy closure, and fewer clear-cut harvest areas. At the nest-stand scale, discriminant function analysis (DFA) separated occupied nest stands ($n = 19$) from random ($n = 30$) based on greater canopy closure, shrub cover, large-sized tree density, and less wood litter; at the nest-tree area, greater total plant cover, canopy closure, large tree density, and less sapling density; and at the nest-tree, greater diameter at breast height and height to the lowest live limb. I also evaluated specific landscape and physiographic features associated with nests, and DFA separated occupied from random sites based on less distance from the nest to a forest opening, less distance from the nest to the edge of the nest stand, and lower elevations. Occupied nest sites were dependent on aspect with 82.6 percent located on north slopes. The number of young fledged per nest was negatively correlated with the size of the forest opening near the nest and sapling densities in nest stands, and was positively correlated with the density of large-sized trees in nest-tree areas. I suggest that well-designed management treatments that maintain large areas of mature forest and focus on reducing small-sized tree densities in the understory should be able to improve existing conditions for goshawks.

Distribution of Forest Carnivores in the Pioneer Mountains, Montana [TWS]

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This project was initiated in the winter of 2000-2001 by the Rocky Mountain Research Station in cooperation with the Western Federal Lands Highway Division (WFLHD) of the Federal Highway Administration. Survey efforts are directed at meeting 2 primary objectives; 1.) Determine the distribution of lynx and other forest carnivores in the Pioneer Mountain Range, and 2.) Determine the location and relative frequency that lynx and other wildlife (forest carnivores, elk, deer, mountain lions, coyotes, and bobcats) cross the Polaris Road. To address the first objective we overlaid suitable habitat within the mountain range with an 8-km grid in order to systematically and quantifiably conduct the large scale surveys. The approach is to cover a minimum of 10 km of survey route within each 8-km pixel. To address the 2nd objective we surveyed the closed portion of the Polaris Road a minimum of 1 time per 10 days. Surveys are conducted only between 48 and 72 hours after significant snowfall. All track data is GPSed and stored in a GIS upon return from the field. Between 1 January 2001 and 20 Februrary 2001a total of 764 km of GPS logged survey have been conducted in the 8-km pixels. Mammalian carnivore track crossings and data pertaining to habitat and prey species are recorded along these routes. In addition to the intensive surveys, approximately 4000 km has been covered in which observers record locations of lynx, wolverine, fisher, and wolves. To date we have not summarized all location data. Wolverine tracks have been detected on 8 survey routes across the mountain range. Wolf tracks have been documented on 2 entries of the same survey route. Martens are commonly encountered within certain habitat types. No lynx or fisher tracks have been documented at this time. We have surveyed the closed portion of the Polaris Road 4 times to date. Martens and coyotes are the most common carnivores using the road. Martens do not appear to travel along the road itself but simply cross. Coyotes are found crossing the road and using it as a travel corridor. Wolverine crossings have been documented on 2 of the 4 surveys. No lynx, fisher or wolf tracks have been detected to date.

Swan Valley Grizzly Bear Conservation Agreement: A Mixed Ownership Landscape Plan [TWS]

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A Conservation Agreement was developed and implemented in 1995 covering approximately 368,000 acres in the Swan Valley of west central Montana between Plum Creek Timber Company, Montana Department of Natural Resources and Conservation, U.S. Forest Service, and the U.S. Fish and Wildlife Service. This management plan allows the cooperators to meet economic and recreational objectives for their ownership while providing conservation benefits to grizzly bears using information from local scientific studies and the newest technology. The biological objective is to maintain landscape conditions conducive to grizzly bears to facilitate their movement between the Bob Marshall and Mission Mountains Wildernesses. Measures have been developed that minimize disturbance to bear habitat and the period of their likely use and to decrease the potential for human-caused mortality. Conservation measures include establishing linkage zones across the valley floor, the stepped rotation of commercial activities through the valley, landscape habitat and access management, and site-specific habitat prescriptions for forest management. Specific plan measures include the curtailment of management activities within linkage zones during the early spring period as bears emerge from dens; coordinating the commercial activity among landowners to occur in only 4 of 11 subunits during the non-denning period; retention of cover at both the landscape and stand level; and reducing public vehicular access in bear habitats by instituting road restrictions and road reclamations. The Plan includes monitoring such as evaluating the effectiveness of road closure devices, sampling administrative use levels within inactive subunits, tracking commercial activity, and reporting landscape cover levels.

Effects of Ponderosa Pine Restoration on Wildlife [TWS]

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Fire suppression in the last century has resulted in major changes in forest structure and process. The National Fire / Fire Surrogate Study is a nation-wide interdisciplinary project designed to assess impacts of restoring forest structure and/or process through the use of silvicultural tools and prescribed fire. Lubrecht Experimental Forest is one of 10 sites in the

study. A team of silviculturalists, soil scientists, entomologists, and wildlife biologists work together to provide insight into the broad impacts of forest restoration. I will be focusing on the effects of the silvicultural manipulations on wildlife. Specifically, I will examine the use and selection of beetle-killed trees by bark gleaners and try to assess how the removal of these trees may affect both food availability and foraging behavior. I will also examine the change in relative densities of small mammals as a result of the silvicultural treatment. I will focus on yellow pine chipmunks and deer mice, both abundant on the sites and both songbird nest predators and large mammal/ large bird prey. Determining theses responses will provide insight into different levels of forest responses, thereby providing valuable information to managers implementing these treatments.

What we can (and Cannot) Say About Wildlife Populations Using Non-Invasive Genetic Sampling [TWS]

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Non-invasive genetic sampling is emerging as a sexy new tool in the arsenal of techniques used by wildlife biologists. Like any new approach, it has promise, as well as pitfalls. I will discuss some genetic-based approaches that I am using, along with my students and other colleagues, to answer applied wildlife ecology questions. For example, abundance of elusive carnivores can be estimated using mark-recapture approaches coupled with non-invasive DNA sampling (such as hair snags), but there is a "shadow effect" that can arise from the failure to distinguish individuals based on unique genotypes. Species identification is also possible using non-invasive sampling, and we have developed diagnostic tests for distinguishing among felids (including lynx), dogs (including coyotes), bears, and mustelids (including wolverines, fisher, and marten) across the northern U.S.; these diagnostic tests are being incorporated into Nationwide sampling of lynx in collaboration with the USFS Rocky Mountain Research Station. Finally, genetic tools can be used to evaluate gene flow, as we have done with both lynx and small mammals. I will stress that genetic tools are valuable, but should not be used without validation; furthermore, the most productive avenue is to combine genetic and demographic (eg mark-recapture) approaches.

Gaining New Insights into Canada Lynx Management using DNA [TWS]

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Genetic data can be used to shed new light on old problems. We used genetic data on the Canada lynx (*Lynx canadensis*) to address questions concerning connectivity between lynx populations. Specifically, we tested if southern lynx populations are maintained by migrants moving from Canada to the United States or if southern lynx populations are self-

sustaining, isolated entities. To address this question we analyzed lynx DNA with nine microsatellite markers and used the data to estimate gene flow between seventeen lynx populations in Canada, Alaska, and the contiguous United States. Our data shows that gene flow is extremely high between most lynx populations. We discuss this finding in light of the Evolutionary Significant Unit (ESU) concept. Furthermore, we emphasize that if lynx populations in the contiguous United States are maintained by gene flow, as our data suggests, then efforts must be initiated to ensure that movement to and from Canada is maintained or enhanced.

Hair Snaring and DNA Identification [TWS]

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In 1999 we developed and implemented a nationwide survey for lynx based on DNA identification of hair. In 1999 over 6000 hair snares were placed in 40 National Forests, and 1 National Park. In 2000 we expanded efforts to 44 National Forests, 3 National Parks, and the Salish-Kootenai Nation; over 7500 hair snares. We tested the efficacy of baited hair-snares, developed DNA primers to separate felids, ursids, canids, and mustelids and designed a protocol that could be implemented consistently by Forest Service employees and contractors across the US. Hair snaring proved effective for surveying lynx. In Kulane N.P., Yukon, a mixture of beavor castorium and catnip oil was twice as effective as 4 other lures tested. Lynx hair was found on 39 percent of the snares baited with this lure. For species-level identification, published mitochondrial DNA primers proved unreliable for amplifying DNA from hair samples. We therefore developed primers that amplified shorter sequences within the D-loop region of the cytochrome b gene, allowing positive identification of felids from very small samples. Surveys were designed to representatively sample relatively large areas while maintaining high probabilities of detection, and four "test" areas with known lynx populations were included to estimate probabilities of detection. In the first year, we obtained over 600 hair samples from the initial survey. While the 2000 samples have not been fully analyzed, we have documented lynx occurrence on 2 areas in northern Washington, in the Seeley Lake area of Montana, the east side of Glacier National Park, and in the Boise and Shoshone National forests. Additionally we identified a Eurasian lynx in the Ashley National Forest.

Non-Invasive Genetic Sampling for Forest Carnivore Population Status at an Ecosystem Scale [TWS]

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We censused populations of grizzly bears and black bears during 1998-2000 on a 8,100-sq. km. study area in northwestern Montana by collecting hair from hair snares and scats from trap grids and survey routes and identifying individuals through DNA analysis. Of the 212 different individual grizzly bears identified during 1998; 121 were detected at systematically placed baited hair traps, 56 from unbaited rub trees, and 35 were detected via both types of samples. Species and gender ratios differed significantly between the three sampling methods. Surveys conducted the first half of the field season yielded larger numbers of samples than later surveys and detected most individuals identified during the entire May – October season. Population point estimates made using a variety of models and combinations of data sets ranged from 343–400 grizzly bears. The 95 percent confidence interval ranged from 263–575 or 33–71 bears per 1000 sq. km. We describe a new noninvasive approach for monitoring bear population trend based on systematic surveys for animal hair and feces. Field collection and population estimation methods, as well as potential sources of genotyping errors and recommendations for minimizing them are described.

Wolf Predation and Predator-Prey Dynamics in the Firehole-Gibbon-Madison Drainages of Yellowstone National Park, WY [TWS]

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Much controversy surrounds the reintroduction of the gray wolf (*Canis lupus*) to Yellowstone National Park (YNP), Wyoming, where a major concern is the effect of this top-trophic level predator on the ungulate populations. The objectives of this study were to examine the prey selection and predation rates of wolves on the ungulate populations in the Madison, Firehole, and Gibbon drainages of Yellowstone National Park. Quantitative data were acquired during the 1998-2000 winters in the Madison-Firehole-Gibbon drainages. The Nez Perce pack, ground-tracked as 2, 7, and 13 wolves in the three successive winters, established the area as an important part of their winter territory. The ungulate prey base in the study area consists of approximately 650 elk and 900 bison throughout the winters. Necropsies were preformed on wolf kills to ascertain the species, age, sex, and condition of the prey to study prey vulnerability and wolf prey selection. In the 3 years of the study, 101 definite and 29 probable wolf kills were located and necropsied, including 70 elk calves, 34 cow elk, 9 bull elk, 1 unknown adult elk, 13 bison calves, 1 cow bison, and 1 unknown bison. Prey switching was evident, differing between the years of the study. The data collected will be used to help predict impacts of wolf predation on the prey populations.

International Review of Wolf Capture, Handling, and Transport – A New Project in Place [TWS]

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As wolf populations expand in North America and on other continents, an increasing number of wolves are captured for research and management. And as wolves in the United States are delisted, management will be transferred to other agencies along with the need to transfer our knowledge of practical, humane, and successful field techniques. Yet currently, there are no standards in wolf capture and handling and no single source of information contrasting and comparing methods necessary for defining standards. Wildlife Veterinary Resources, Inc. (WVR) is compiling an international review of wolf capture, handling, and transport. WVR, a tax-exempt organization dedicated to building upon our professional experiences, is developing funding, clerical support, and editors to help wolf professionals compile their growing published and unpublished knowledge. The goal for this comprehensive review is to assemble detailed information from as many qualified wolf professionals as possible in a format acknowledging their contributions. Databases will include: 1) published literature, 2) unpublished information, 3) equipment with company information, and 4) contact information of wolf professionals to facilitate networking. This project is the first comprehensive international review for any wildlife species and will serve as a model for other wildlife. A strategy team of wolf professionals will consult on the review process and address pertinent questions and concerns. Wolf professionals are invited to contribute.

Status of Gray Wolf Restoration in Montana, Idaho, and Wyoming [TWS]

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Gray wolf (*Canis lupus*) populations were eliminated from Montana, Idaho, and Wyoming, as well as adjacent southwestern Canada by the 1930s. After human-caused mortality of wolves in southwestern Canada began to be regulated in the 1960s, populations began expanding southward. Dispersing individuals occasionally reached the northern Rocky Mountains of the United States, but lacked legal protection there until 1974, after passage of the Endangered Species Act (ESA) of 1973. In 1986 wolves from Canada successfully raised a litter of pups in Glacier National Park, Montana, and a small population was soon established. The Recovery Plan for the wolf in the northern Rockies of the United States identified northwestern Montana, central Idaho, and the Greater Yellowstone Area (GYA) as recovery areas and established a biological goal of at least 30 breeding pairs of

wolves throughout these 3 areas for 3 successive years. In 1995 and 1996 wolves from western Canada were reintroduced to remote public lands in central Idaho and Yellowstone National Park. Those wolves were designated as nonessential experimental populations to increase management flexibility and address local and state concerns. The Service proposed to reclassify endangered wolves in northwestern Montana to threatened status and manage them similarly to the wolves in the experimental population areas. That proposal should be finalized by July 2001. Wolf restoration is rapidly occurring in Montana, Idaho, and Wyoming and there were at least 25 breeding pairs in December 2000. Currently there are about 61 wolves in northwestern Montana, 185 wolves in central Idaho, and 164 wolves in the GYA. Dispersal of wolves between Canada, Montana and Idaho has been documented but only 1 wolf has successfully traveled to or from the Yellowstone area. Occasional lone wolves are expected to disperse into adjacent states but pack establishment outside of Montana, Idaho, and Wyoming is probably not imminent. At the current rate of population growth the gray wolf in the northwestern U.S. should be recovered and, depending on the status of state and tribal wolf management plans, could be proposed to be removed from the ESA within 3-5 years. Wolf restoration has proceeded more quickly and with more benefits, such as public viewing than predicted. Problems, including confirmed livestock depredations, have been lower than estimated. Wolves have restored an important ecological process to several large wild areas in the northern Rocky Mountains of the U.S. The program has been widely publicized and is generally viewed as very successful.

Wolf Management in Montana [TWS]

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The wolf is listed under the federal Endangered Species Act of 1973 and Montana's Nongame and Endangered Species Conservation Act of 1973. Among the federal requirements for delisting, the states of Montana, Idaho, and Wyoming must have management plans in place to ensure that the recovered wolf population will remain secure within the northern Rocky Mountain Recovery Area. The Montana Wolf Management Advisory Council was appointed by an Executive Order signed by former Governor Racicot. The Council is charged to advise Montana Fish Wildlife and Parks as it prepares a management plan for wolves once they are delisted. The Council is comprised of 12 members from around the state who represent a variety of interests including tribal, agriculture, hunting, and wildlife conservation. Using an "interest-based" process, the Council specifically deliberated issues related to: defense of life and human safety, livestock depredation, compensation, management of prey populations, and wolf conservation and management. By consensus, the Council adopted 26 Guiding Principles which will serve as the foundation for Montana's Wolf Management Plan. The Council recognizes the wolf as a native species and a valuable part of our wildlife heritage. Integrating and sustaining wolves within the complex biological, social, economic, and political landscape of Montana presents many challenges and opportunities that all Montanans share. The State of Montana must ensure human safety, safeguard the livestock industry, maintain viable wildlife populations, and uphold the support of people with diverse public interests. The presentation will summarize the Council's Report to the Governor.

The Role of Natural Resource Professionals in Outreach Education [TWS]

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Most resource management professionals have a vocation rather than a job. A vocation is a rare and precious possession, but it obligates natural resource professionals to greater expectations. Our vocation demands from us that our actions truly benefit wildlife, rangelands, and other natural resources. Simply punching the clock is not enough. Our actions are more effective when we reach beyond our ranks and communicate with others who share an interest in natural resources. The size and diversity of this audience is great and ever-expanding, including youth, environmental and conservation groups, sportsmen, commodity groups, policy makers, and other concerned citizens. Natural resource professionals need to seize every opportunity to make a positive difference and relish the pleasure of talking about our favorite subject with other people. We need to share our passion for our vocation and the natural resources we love. Enthusiasm is infectious and encourages people to listen to our message. However, effective communication ultimately depends on honesty and credibility. We must try not to proselytize our audience, but instead provide people with factual information. Empowered with this knowledge, our audiences may reach the same conclusions that we have, and may eventually share our personal values and opinions about natural resources. It is imperative, however, that we recognize the values and opinions of others and try our best to understand them. This approach enables natural resource professionals to experience one of the miracles of teaching, when after the session, not only the audience knows more, but so does the speaker.

Making Your Presentations Easy and Effective [TWS]

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USDI Bureau of Land Management/Montana Fish, Wildlife & Parks
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How many of us dread that inevitable phone call that starts off something like this: "Can you come and give a presentation to my class of 100 7th graders tomorrow?" Do those words strike fear in your heart? You need not feel out there all alone. Help is just a phone call away. Biologists and specialists are often called upon to provide presentations for school groups and service organizations. Your presentation can be made much easier and more effective with a variety of tools, tips and props at your disposal. This presentation will discuss and show examples of these tools and provide resource lists for your use.

The Wildlife Investigator Series [TWS]

William I. Dean
USDI Bureau of Land Management, Butte Field Office, Butte, MT 59702

John J. Van Niel
State University of New York, Finger Lakes Community College, Lincoln Hill Campus, Canandaigua, NY 14424

The Bureau of Land Management and Finger Lakes Community College have developed wildlife educational programs for use by wildlife biologists and this presentation is part of the peer review process. The Wildlife Investigator Series includes three wildlife education programs: Wildlife Biologists - a day in the field; Wildlife Trees, Snags and Logs; and Skulls, Antlers and Horns. They are prepared for use with primary, middle, and high school students. Each program has a base lesson from which all lessons are extended. Each Program will include: photographic slides with narration; "hints for presenters"; activities; handouts; and CDROM with power point presentation. Lessons are designed to last between 25 and 45 minutes, and can be customized by presenters to meet her/his needs. Students will be given tasks to encourage critical thinking and applied knowledge. These programs meet Montana State Board of Education Standards. This project will provide positive exposure for resource management agencies, quality educational experiences for persons of all ages, a public more informed about and more appreciative of wildlife resources, and increased public understanding of the BLM's mission and goals. These programs will be presented in a BLM Technical Note publication including a CD.

Building Partnerships for Enhancing Montana's Madison and Missouri River Corridor [TWS]

Jon Jourdonnais
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PPL Montana and state and federal resource agencies have recently signed a 10 year Memorandum of Understanding (MOU) which provides a consultation framework and funding mechanism for implementation of wildlife, fisheries, water quality, and habitat protection, mitigation, and enhancement measures for the 500 mile Madison and Missouri River corridor as part of PPL Montana's Project 2188 FERC License. The MOU combines efficiencies and innovation in the operation of competitive corporate business with public agency and NGO incentives for adaptive resource management. The MOU collaborative, in the first year of implementation, has identified significant cost-share partnerships exceeding $50 million over the next 10 years between PPL Montana, resource agencies, and NGO's for various fisheries and wildlife projects including wetland, riparian, and associated upland restoration projects within the river corridor.

Streamflow and Cottonwood Recruitment [TWS]

Gregor Auble
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Cottonwood stands along the Wild and Scenic reach of the Missouri River in Montana are sparse and discontinuous. Because the recreational and wildlife values of these stands are high, there are concerns about how flow alteration and cattle grazing may be limiting reproduction. A retrospective study using tree excavation and dendrochronology established that current trees were disproportionately established in flood years. Results from an ongoing monitoring study suggest that (a) in most years large numbers of new seeds germinate in the bare, moist zone between the flow lines of the spring peak and fall minimum; (b) seedling mortality in subsequent years is extremely high because of grazing, flood damage, and winter ice scour; and (c) successful recruitment is most likely when infrequent high flows have positioned seedlings high on the bank, where local channel movement occurs, and when grazing intensity is low.

Protecting Riparian and Wetland Habitats in the Madison and Missouri Valleys as part of the Montana Wetlands Legacy [TWS]

Tom Hinz
Montana Fish, Wildlife & Parks, Bozeman, MT 59717

Although agencies and organizations across Montana have been in the business of protecting wetlands, riparian areas, and uplands for several decades, many of these programs have been operated independently or in limited partnerships. With federal funds, foundation grants, and other state, regional, national and international funding sources becoming increasingly more available, a fully-integrated collaborative approach to land and water protection makes most sense for Montana. In the area of wetland and riparian protection, the Montana Wetlands Legacy is such an integrated partnership. Formed in May, 2000, the Legacy partnership includes representatives of every major on-the-ground habitat protection organization in the state. In 2000, the Legacy adopted a short-term goal of protecting 100,000 acres of wetlands, riparian areas, and associated uplands throughout Montana by 2005. The issuance of the FERC order to PPL-MT for operation of its nine major dams on the Madison and Missouri Rivers over the next forty years provided a unique opportunity for conservation partners, including the Montana Wetlands Legacy, to partner with PPL-MT's sizeable and long term source of private funds for riparian and wetland protection. The Montana Wetlands Legacy partners have begun the process of matching PPL-MT funds with state and federal program dollars, as well as those from private conservation groups, to purchase conservation easements, manage grazing along streams, and to gather information on wildlife populations, distribution, trend and abundance in the Missouri-Madison area. Ultimately, through the Montana Wetlands Legacy and related partner efforts, we hope to protect the best of these important wetland and riparian habitats.

Assessing Winter Recreation Effects on Stress Hormone Levels of Elk and Bison in Yellowstone National Park [TWS]

Amanda R. Hardy, Robert A. Garrott, and Scott R. Creel
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The effect of winter recreation on animal populations is widely debated, particularly since a recent decision by the US Department of the Interior to ban snowmobiles from National Parks. Immunoassays of fecal glucocorticoid levels provide a noninvasive method of measuring physiological stress responses of wildlife to disturbances. Here, we relate snowmobile activity to glucocorticoid levels of an elk (*Cervus elaphus),* and bison (*Bison bison*) population in Yellowstone National Park. In preliminary results for elk, day-to-day variation in fecal glucocorticoid levels tracked variation in the number of snowmobiles, after controlling for effects of weather and age. Glucocorticoid concentrations were higher in response to snowmobiles than in response to wheeled vehicles, after controlling for effects of weather, age and number of vehicles. Results for bison are pending. Despite these stress responses, there is no evidence that current levels of snowmobile activity are affecting population dynamics for either species.

Adult Female White-Tailed Deer in Montane Environments: What are We Managing and What are We Counting? [TWS]

Carolyn A. Sime
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Despite their popularity as a big game animal and prevalence in the hunter bag, comparatively little is known about white-tailed deer response to various hunter harvest strategies in montane environments. Prior to developing an adaptive management protocol for white-tailed deer, it is important to evaluate the regulation packages and validate their anticipated outcomes. In addition, it is important to validate a monitoring protocol. One objective of the Northwest Montana Deer Research Project is to investigate the effects of various regulation types and variable harvest opportunities for antlerless deer. Telemetry was used to determine adult female harvest rates in each of two hunting districts (HD) under various regulation packages and variable antlerless harvest opportunity through time. Whereas the regulations pertaining to the general deer "A" license were consistent for each district, they did change through the 1988-2000 period of study. Antlerless harvest opportunity also changed during the period, though the changes were systematically adopted in only one HD during the hunting seasons 1991-1996, while the other HD served as a control. This permitted comparisons through space and time. Biologists frequently utilize results from the annual telephone harvest survey to monitor trends in total deer harvest for various age and sex categories. Estimates for antlerless harvest (number of deer harvested) were compared to estimated harvest rates of telemetered does. Abiotic factors were also considered. The presentation will summarize preliminary results.

Adaptive Harvest Management Of Mule Deer In Montana [TWS]

David F. Pac
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A decline in mule deer populations in the mid-1990's provided impetus for innovation in mule deer harvest management. The FWP Commission officially adopted the Adaptive Harvest Management (AHM) process in 1998. Recognizing that there is much we do not understand about the dynamics of mule deer populations sets AHM apart from traditional forms of management. Strong differences of opinion concerning the effects of hunting regulations on population trends result from uncertainty about the effects of hunter harvest. A redesign of the entire management process improves identification and consideration of these uncertainties to reveal new knowledge about the resource. Four basic components are linked in this process: 1. Population goals and objectives are specific to differences in population characteristics among five important environments. Objectives for each environment define levels of fluctuation more acceptable to landowners and hunters. 2. Population monitoring has been reorganized to increase quality and consistency of data on population size and composition using standardized methods. Monitoring includes two levels of aerial survey intensity: trend areas and census areas. The former are flown twice per year (post-hunting season and spring) and the latter 4 times per year (post-hunting season and 3 times in spring). Post-hunt surveys occur between December 1 and January 15 and spring surveys between March 15 and April 30. Trend areas provide data on status of local populations at 67 sites across land ownerships and land-uses. Replicate surveys during spring on census areas provide detailed data on size and composition of 13 important populations across the major environments. Monitoring data define population status in relation to objectives and connect together the other components of the AHM process. 3. Hunting Regulations in a three-part package (restrictive, standard, liberal) provide an array of harvest rates for populations in each environment. Recommendations to change regulations are triggered by a priori thresholds of population size and composition. 4. Computer Models of prairie and mountain mule deer populations have been constructed using STELLA modeling software. Data on population size and composition from the 13 census areas are integrated with environmental data and harvest regulations to predict population status one year into the future. Feedback between modeling and monitoring allow comparison of model predictions to observed population data. This process improves detection of significant changes in population status and provides more timely response. Annual iteration of the AHM process brings harvest management closer to an organized experiment, rather than simply an ongoing experience.

Estimating Total Human-Caused Mortality from Reported Mortality Using Data from Radio-Instrumented Grizzly Bears [TWS]

Steve Cherry
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Mark Haroldson and Charles C. Schwartz
USGS Northern Rocky Mountain Science Center, Interagency Grizzly Bear Study Team, Forestry Sciences Lab, Montana State University, Bozeman, MT 59717

Tracking mortality of the Yellowstone grizzly bear (*Ursus arctos horribilis*) is an essential item of the recovery process. Agency removal of problem bears is known. Additionally, the public reports an unknown proportion of bears they kill. Estimating the number of non-agency human-caused mortalities is a necessary element that must be factored into the tally of total annual mortality. Here, we describe a method of estimating non-agency human-caused grizzly bear deaths from records of reported human-caused bear mortalities. We used a hierarchical Bayesian model, with an assumed noninformative prior distribution for the number of deaths. Information from reporting rates of deaths in radio-instrumented bears from 1984 to 1999 is used to develop 3 beta prior distributions on the probability that the public will report a death. Different prior results from different assumptions about the fates of unexplained/unresolved loss of signal incidents. We apply the method to reported human-caused mortalities in running 3-year time periods starting in 1993 through 2000. Two distinct data sets are analyzed: one with possible deaths included and one with possible deaths excluded. We believe results from the described method can be combined with agency removals to produce defensible estimates of total mortality over relevant time periods and incorporate uncertainty when evaluating mortality limits established for the Yellowstone grizzly bear population. Assumptions and limitations of this procedure are discussed.

The Effect of Environmental Variability on Grizzly Bear Habitat Use: A Work in Progress [TWS]

Doug Ouren and Charles Schwartz
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Robert Garrott
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The grizzly bear (*Ursus arctos*), with mean adult home range sizes ranging from just under 500 square kilometers to over 800 square kilometers, is a wide-ranging omnivorous carnivore whose habitat requirements are challenged daily by increasing habitat fragmentation. Many of the measurable parameters that characterize habitat use by grizzly bears are influenced by the quality, quantity and distribution of available resources at many temporal and spatial scales. The availability of these resources is further complicated by the annual and inter-annual variability in human land use patterns and a suite of climatic variables. In order to gain ecological insight regarding how the grizzly bear uses the

landscape and what effect human land use changes have on that landscape, it is important to determine the daily movements of grizzly bears. Delineating daily movements and determining the location of resources that act as attractants vs. resources that act as deterrents is an objective of this project. The global positioning system (GPS) technology provides scientists with location information having a high degree of certainty and at user defined intervals. This paper will present the initial findings of a multi year study, based in the Greater Yellowstone Ecosystem, using the technologies of GPS, Geographic Information Systems and remotely sensed data to assess the effects of resource management strategies and land use practices on grizzly bear habitat selection. To date 26 grizzly bears have been instrumented with GPS collars. Based on data from retrieved this project has been able to illustrate that there are indeed patterns of use delineated using the GPS technology that were not captured using traditional radio telemetry methods. Grizzly bear home ranges delineated using this technology are much more discrete showing areas of concentrated use. These results appear to have promise in providing new ecological insights on grizzly habitat selection.

Ecosystem Scale Linkage Identification and Implementation for Grizzly Bears and Other Rocky Mountain Carnivores [TWS]

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The fragmentation of carnivore habitat in the Rocky Mountains on both sides of the U.S.-Canada border is an ongoing threat to the survival and recovery of these populations. Human developments are the cause of this fragmentation. Major developments causing fragmentation include private land conversion into homesites and highway construction and improvement. If carnivores such as grizzly bears (*Ursus arctos horribilis*), wolves, (*Canis lupus*), wolverines (*Gulo gulo*), lynx (*Lynx lynx)*, and fishers (*Martes pennanti*) are to survive and recover to healthy population levels in the Rocky Mountains, the issue of fragmentation must be addressed in a proactive and effective manner. Addressing the issues of habitat fragmentation for carnivores requires an organized effort. We have been involved in the development of a linkage zone identification effort as part of the grizzly bear recovery program. As part of this effort, we have developed a linkage zone prediction model that was used to identify the linkage areas within and between the major blocks of public lands in the Rocky Mountains of Montana and Idaho.There is a need for careful management of activities to allow carnivores the continued opportunity to move across lands in linkage areas. We have proposed general management considerations on public lands to facilitate movement across such areas by carnivores. Lands that offer the greatest threat to movement and occupancy by carnivores are private lands where development and subdivision can have serious impacts on wildlife and the statutory authority of the government under the Endangered Species Act is minimal. Management efforts must be undertaken on these lands with the cooperation and coordination of the owners. Suggested management activities on private lands to maintain linkage opportunities for carnivores were discusssed. Highways are a major factor in habitat and population fragmentation. As existing highways are improved for safety and increased traffic, they become increasingly difficult for wildlife to cross. Designing highways to allow wildlife crossing will also improve human safety by decreasing vehicle-wildlife collisions saving human and animal lives. Suggestions for maintaining and enhancing crossing of highways by carnivores were discussed. The future cumulative levels

of human development on private lands combined with accelerating highway improvements will result in complete fragmentation of many carnivore populations unless management of linkage zones is initiated immediately. It will be necessary for management efforts to simultaneously address the linkage needs on public and private lands and on the highways that traverse these areas. It will be much easier to maintain opportunities for population linkage than to recreate them, so the time for action is now.

Do Highways Form Barriers to Small Mammal Movement and Gene Flow? TWS

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Highways can adversely affect wildlife populations by increasing mortality due to vehicular collisions and by discouraging crossing attempts, leading to decreased connectivity among populations. We are investigating these issues using small mammals as a model system. First, we are using mark-recapture analyses to compare movement adjacent to highways to movement across highways for small mammals in forested areas in western Montana. Second, we are determining rates of gene flow across highways and the degree of genetic differentiation that may have occurred in red-backed voles (*Clethrionomys gapperi*), deer mice (*Peromyscus maniculatus*), and vagrant shrews (*Sorex vagrans*). In our first field season, we recorded 1378 captures of 624 individuals of 10 species. Preliminary results indicate that more individuals moved between grids on the same side of the highway than between grids separated by the highway: 39 movements adjacent to the highway versus 16 movements across the highway. These 55 movements were completed by 40 individuals, 75 percent of which were male. Deer mice and chipmunks appeared to be more successful at crossing highways than red-backed voles. Only one vole (who crossed twice) was ever captured on both sides of the highway, compared to seven movements of five individuals adjacent to the highway. Our goal is to assess the barrier effect of highways of different widths on various species of small mammals, so that these negative impacts can be identified and mitigated in the future.

Mitigating the Effects of Kerr Dam on Wildlife Within the Flathead Indian Reservation TWS

Art Soukkala, Dale Becker, Janelle Corn, and Brett Gullett
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Kerr dam was initially licensed in the 1930s and began controlling the outflow of Flathead Lake in 1938. A new license was applied for and granted in 1985 contingent on mitigation measures to be determined. Impact studies, damage assessments and an initial mitigation plan were completed in 1990. The Federal Energy Regulation Commission approved a partial settlement in 1998 and a final settlement in January 2001. Documented losses include 1792 acres of wetland and riparian habitats along the shores of Flathead Lake

and 985 acres of shoreline habitat along the lower Flathead River lost because of altered lake and river hydrographs, and 624 acres of riparian habitat along the lower Flathead River lost because of flood control. Half of the lost riparian acres (312) were attributable to operations at Hungry Horse Dam on the South Fork of the Flathead River and will not be mitigated under the Kerr settlement. A Fish and Wildlife Implementation Strategy was developed that covers program goals, specific mitigation activities, threatened and endangered species, monitoring methods, and an adaptive management strategy. A Habitat Acquisition and Restoration Plan was developed that outlines acquisition priority areas on the Flathead Reservation, criteria to prioritize individual parcels, an accounting system to measure habitat crediting and a structure for restoration and management activities. This paper will give an overview of the Confederated Salish and Kootenai Tribe's acquisition plans, management goals, restoration efforts and other activities planned as part of this mitigation effort.

Sage Grouse Status and Harvest Opportunities in Northeastern Montana [TWS]

Pat Gunderson
Montana Fish, Wildlife and Parks, Glasgow, MT 59230

A population of sage grouse (*Centrocercus urophasianus*) in Valley County, Montana were first investigated 45 years ago. Three leks have been surveyed over most of this time period. Since 1989, managers have intensively surveyed a 36,000 ha block area within the county. Information from this block area has become the tool for local managers in assessing sage grouse trends. In past two years sage grouse leks in the entire southern half of the county have been searched for and surveyed. Numbers of male sage grouse observed in 2000 numbered over 1300 in Valley County. By using the relationship between the block area, total counts over the past two years and fall wing harvest collections, managers were able to estimate spring and fall populations since 1989. Yearly estimates from the statewide harvest surveys have found the harvest in Valley County to vary from just over 250 to over 1800 sage grouse since 1989. During this period, hunting seasons varied from 62 to 107 days in length, had daily limits between 2 and 4 birds and possession limits between 6 and 16 birds. Comparisons between the population and harvest estimates reveal a population that is independent of the liberal hunting opportunities offered.

Montana-Wide Burrowing Owl Surveys; A Synthesis of First and Second Year Efforts, 1999-2000 [TWS]

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In 1999, we initiated the first statewide survey efforts for Burrowing Owls (*Athene cunicularia*) across Montana with a stratified random inventory of 204 black-tailed prairie

dog (*Cynomys ludovicianus*) colonies yielding an estimate of 644 + 114 owl pairs inhabiting Montana prairie dog colonies. During 2000, 28 cooperators surveyed 187 prairie dog colonies estimating that 727 + 168 Burrowing Owl pairs inhabited Montana colonies. Seven hundred seventeen owls were observed including 134 pairs. Of 1353 colonies within the working dataset comprising approximately 67200 acres (27206 ha), we surveyed 15.1 and 13.8 percent by number and 15.0 and 14.3 percent by area (10079 acres, 4081 ha; 9602 acres, 3887 ha) during 1999 and 2000, respectively. Seventy-nine colonies contained owls yielding an occupancy rate slightly higher in 2000 than during 1999 (42.25 vs. 38.24%, respectively). Although surveyors appeared to observe greater numbers of owls during year 2000 (mean + SE; 3.59 + 0.56 vs. 2.29 + 0.30) the difference was not significant. There was a small tendency to observe greater numbers of adult females, young, and adult males during 2000 but these trends were negligible when adjustments for multiple comparisons were made. No significant difference between years in number of owl pairs per surveyed colony was detected. Analysis of bellweather and random colonies is ongoing for determining trends.

A Comparison of Sin Nombre Virus Prevalence in Peridomestic Versus Sylvan Populations of Deer Mice [TWS]

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Most cases of hantavirus pulmonary syndrome (HPS) are likely acquired in peridomestic settings, including human dwellings, out-buildings, corrals and ranch yards, yet studies of the ecology and infection dynamics in the reservoir host, the deer mouse (*Peromyscus maniculatus*) have focused on sylvan populations. We describe a 2.5-year study of hantavirus infection in rodents associated with peridomestic habitats at three study sites in west-central Montana. Antibodies reactive with Sin Nombre virus (SNV) were found in 5 species. Overall SNV antibody prevalence was highest among deer mice (25% of individuals tested). Characteristics of these peridomestic populations of deer mice were then compared with those of sylvan populations from 6 different sites in western and central Montana. In both types of populations, the antibody-positive component of the deer mouse population consisted of a higher proportion of adults and males. However overall SNV antibody prevalence and average monthly prevalence was significantly higher in the peridomestic populations. The higher SNV antibody prevalence in peridomestic compared with sylvan settings may be related to behavioral differences and/or potentially longer survival of the virus deposited inside buildings. Peridomestic settings presented higher concentrations of virus and may present a higher risk of human infection than do sylvan settings.

Landscape Effects on Duck Nesting Success in the Missouri Coteau Region of North Dakota: Preliminary Analyses [TWS]

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Mark Lindberg
University of Montana, Missoula, MT 59812

Jim Ringelman
Ducks Unlimited Inc.

Understanding relationships between landscape characteristics and demographic parameters is a critical component of maintaining viable populations in human altered ecosystems. Thus, this information is paramount for natural resource managers charged with implementing successful conservation programs. We are currently investigating nesting success rates for dabbling ducks across a gradient of landscape types in the Missouri Coteau region of North Dakota. A variety of functional forms of the relationship between nesting success and the amount of grassland cover in the landscape are possible. Each form would result in dramatically different management implications, if operating. We used simulation modeling to help guide the design of this study to maximize our ability to discern among the various forms of this relationship. The appropriate scale at which to measure the landscape characteristics was also of interest in this work. This study was designed to examine landscape characteristics at 4 and 36 square mile spatial scales. Eighteen study sites were selected using satellite imagery to obtain a range of grassland levels at both the 4 and 36 square mile scale. As a result, study sites encompass the full gamut of landscape types from those dominated by agricultural fields to sites entirely comprised of native pasture. During the first field season, 2,200 duck nests were located using chain drag techniques and monitored for success along with over 150 nests of other grassland nesting birds. Preliminary estimates of nesting success from this first field season will be presented along with initial plots of the grassland-nesting success relationship.

Suitability of Montana Wildlands for Bison Reintroduction [TWS]

Craig J. Knowles
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Montana contains several large tracts of wildlands that would be suitable for bison (*Bison bison*) reintroduction. Four of these sites were selected for further consideration and were found to range in size from 187,458 acres to 895,503 acres. Each of the sites contained greater than 90 percent Federal and state ownership, and were largely uninhabited. Two sites would support resident bison herds in prairie/river breaks habitat and two sites would support migratory bison herds in mountain/foothills habitat. Bison could be obtained from Federal and state-owned bison herds that utilize similar habitats as the proposed reintroduction areas. All reintroduced animals would come from herds free of regulatory diseases, and would be certified as healthy by a qualified veterinarian. Reintroduction would begin with a soft release of five yearling bison at each site to establish a herd range within a specific area. Once established, additional bison could be added to the herds as necessary. Principles of modern conservation biology would be used to maintain genetic diversity

within and between herds through periodic translocations and introductions. Bison herds would be allowed to expand to 50 adults at which point they would be managed through regulated public hunting. Wild bison are classified as a game animal in Montana and would be held in the public trust. Montana Fish, Wildlife and Parks has management authority over disease-free wild bison and existing statutes are suitable for management of wild bison. Small bison herds are expected to be extremely cohesive, utilize habitats differently than cattle, distribute their range utilization over a broad area, and to be compatible with existing land uses and other wild ungulates.

Coal Bed Methane – Too Many Unanswered Questions [TWS]

Steve Gilbert
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Issues affecting people in Rosebud and Powder River Counties are felt by people in Missoula, Great Falls, Bozeman and Helena. Diminished water quality in the Tongue and Powder rivers affect all Montanans. Coal bed methane (CBM) is being pumped from coal seams in southeast Montana. High natural gas prices, cheaper drilling technology, and a need for cleaner-burning fuels has spurred rapid growth of the CBM industry. Unfortunately, there is no scientific data showing that CBM development is environmentally advisable. Why would the agricultural community be up in arms against what appears to be a benign type of development that could be a boon to local economies and create more apparent water in a semi-arid region? Montana farmers and ranchers and others who are familiar with this country are afraid because there are too many unanswered questions and too many obvious negative impacts associated with CBM development. Redstone's project on the CX Ranch at Decker presently operates 143 wells, with more to come when the permitting process allows them. According to a briefing paper prepared by DEQ, "Every minute, each well produces about 20 gallons of salty, sodium-rich water that may contain toxic substances (including arsenic and barium at concentrations exceeding water quality standards). At this rate, 30,000 wells could potentially discharge enough of this brackish water to roughly double the flow of the streams in the Powder River Basin CBM region during the irrigation season." Hundreds of active wells are presently discharging polluted water directly to Tongue and Powder River and their tributaries. Extracting methane involves pumping millions of gallons of water out of coal seams onto the land, water that cannot be used to irrigate haylands or gardens because of the salts and other dissolved solids – water that kills the vegetation and the soil. According to DEQ, other potential impacts include dewatering of local and regional aquifers, decreased natural surface water availability in some areas, increased brackish surface flow in discharge areas, miles and acres of roads and surface facilities, erosion, sedimentation, and increase of sodium and other soluble pollutants to streams that will have substantial impacts on native fish populations. There may also be ground water reduction that dries up stock water, loss of natural artesian well pressure, increased saline seep, increased air and noise pollution from compressors, lower water tables, and significant water quality degradation. Prospects of thousands more wells in this country should concern all of us. I fear not only the obvious potential impacts to Montana's surface and ground waters, but to already significantly reduced sage and sharp-tailed grouse populations, nesting neotropical birds and raptors, and impacts to daily and seasonal movements of mule deer and pronghorn, to name a few. Tongue River supports many warm, cool and cold-water gamefish species that will be negatively affected by pollution. These are just a few of the known environmental costs. On the unknown side of the ledger, DEQ admits they don't have a clear understanding of the

myriad cumulative negative effects of CBM development, and they willingly admit there are more questions than answers regarding impacts.

Bison and Brucellosis: Integrating Research and Management [TWS]

Keith Aune
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Previous management efforts designed to minimize the risk of transmission of brucellosis from free-ranging bison and preserve Montana's brucellosis free status have been hampered by the lack of specific scientific information. Interim management strategies were conservative and sometimes extreme because of the uncertainty associated with management decisions in the absence of quality risk management data. Early management discussions and even public debates were based on various untested hypothesis and subjective scientific opinions in the absence of specific research data. Answers to basic questions about pathogenesis, epidemiology, and possible treatment/risk management strategies were not available and research to address these topics was not in place. Recent efforts by multiple agencies to examine the pathogenesis and epidemiology were begun in 1995. Additional research into vaccine safety and efficacy were also initiated and are nearing completion. Recent discoveries from these studies include tissue localization of *Brucella abortus* following exposure and active infection, serology-culture relationships, serologic conversion rates, age specific infection rate, manifestations of the disease in bison, shedding of brucellosis in the environment, persistence of brucellosis in the environment, possible mechanisms of transmission, potential vaccines, and vaccine safety in non-target species. Additional research projects are proposed or underway to further define persistence of brucella in the environment, determine disappearance rates of fetuses in the Greater Yellowstone Area, monitor the infectiousness of sero-negative pregnant bison, explore vaccine delivery using biobullet technology and determine if latency of infection occurs in sero-negative calves. The final state-federal bison management plan was approved in December, 2000. The management plan describes an adaptive management strategy that incorporates specific research projects and monitoring to help define parameters to be incorporated into the decision process. Results from recently completed and ongoing research efforts are providing detailed definition to a complex management problem and provide critical information for advanced risk modeling. This presentation describes current progress in brucellosis research and application of these findings to management strategies outlined in the long-term state/federal bison management plan. Much progress has been made in understanding and further defining a complex problem, which provides a significant step toward managing the problem.

Prairie Dog Panel - Perspective of the Conservation Community [TWS]

Minette Johnson
Defenders of Wildlife, 114 West Pine Street, Missoula, MT 59802

Defenders of Wildlife is a national non-profit conservation organization of more than

400,000 members and supporters dedicated to preserving the natural abundance and diversity of wildlife and its habitat. We have been working on prairie wildlife conservation in our northern Rockies regional office for over a decade. In 1995 we commissioned a study to evaluate the status of black-tailed prairie dogs. We were concerned by the apparent declines in the species particularly because the black-tailed prairie dog is a keystone species of the grasslands. It is estimated that 170 species rely at some level on prairie dogs for their survival, including America's rarest land mammal, the black-footed ferret. The 1995 study documented that black-tailed prairie dog acreage had been reduced by 98 percent nationwide since the turn of the century. Similar declines have occurred in Montana, where we now have only 70,000 acres occupied by prairie dogs. Large-scale poisoning campaigns, habitat loss primarily from conversion to agriculture, sylvatic plague, and shooting have all contributed to the shrinkage of their range. Defenders of Wildlife and other conservation organizations are taking numerous steps to improve the plight of black-tailed prairie dogs and to conserve and restore grassland ecosystems in Montana and throughout the Great Plains.

Prairie Dog Panel - Perspective of the Bureau of Land Management [TWS]

Marc Whisler
USDI Bureau of Land Management, P.O. Box 36800, Billings, MT 59108

As a federal agency, the Bureau of Land Management (BLM) has a trust responsibility to ensure that actions authorized on BLM administered lands do not contribute to the need to list any species under the provisions of the Endangered Species Act (ESA). In Montana, both the white-tailed prairie dog (a BLM Sensitive Species) and the black-tailed prairie dog (a Federal candidate species) fall under BLMs Special Status Species management direction. The BLM State Director is responsible for developing and implementing programs for the conservation of Special Status Species. As such, the State Director will coordinate with State and other Federal agencies, various private organizations, and BLM constituents. Pursuant to this direction BLM has been an integral partner of the Montana Prairie Dog Working Group since its inception in 1996. Prior to that the BLM was a primary partner in the Montana Black-footed Ferret Working Group and assisted with the development and publication of the Montana Prairie Dog Management Guidelines (Montana Black-footed Ferret Working Group, 1988). BLM also co-authored The Prairie Dog Ecosystem: Managing for Biological Diversity. BLM must insure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any federal endangered or threatened species. Given the extensive habitat for prairie dogs on BLM administered lands in Montana, the dependence of black-footed ferrets on prairie dogs, and the need for continued recovery efforts for black-footed ferrets, the BLM is an essential partner and cooperator for conservation of prairie ecosystems and their associated species.

Prairie Dog Panel - Perspective of the Fish and Wildlife Service [TWS]

Lou Hanebury
USDI Fish & Wildlife Service, 2900 4th Avenue North, Room 301,
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On February 4, 2000, the U.S. Fish and Wildlife Service published a 12-month Administrative Finding for a petition to list the black-tailed prairie dog. The Service believed, at that time, that sufficient information was currently available to support a decision that listing the black-tailed prairie dog as threatened is warranted, but that a proposed rule was precluded by work on other higher priority species. The U.S. Fish and Wildlife Service is currently re-evaluating the status of the black-tailed prairie dog and will soon publish a Federal Register Summary and Candidate Assessment form. The species may remain on the candidate list and maintain its listing priority number. In our original finding, the Service found that the recent decline of black-tailed prairie dog occupied habitat is due to several factors, the most influential of which is the widespread occurrence of plague, an exotic and completely lethal disease to the species. Plague could have an even more significant impact on the species if it manifests itself in portions of the range unaffected to date. In concert with plague, the loss of suitable habitat, and inadequate regulatory mechanisms may act upon fragmented populations to threaten the continued existence of the species. Although a number of proposals for regulatory change and active conservation have been proposed, few or none of consequence has been achieved. Plague and inadequate regulatory mechanisms remain the primary challenges and it will take active management range wide to adequately address these threats.

Prairie Dog Panel - Perspective of the Agricultural Community [TWS]

Ken Blunt
HC 84, Box 8180, Malta, MT 59538

History of my personal involvement in prairie dog issues will be described, as well as how local citizens of Phillips County have been involved in the process since the early 1980's. The history of prairie dogs in Phillips County, and historic and present population levels will be described. Contributions and sacrifices of landowners during the past years of involvement with prairie ecosystem issues will be presented, along with a description of impacts to crop and rangeland resources due to high numbers of prairie dogs. The potential effects of the Montana Prairie Dog Conservation Plan on landowners will be addressed.