Biological Sciences – Terrestrial

Beaver Effects On Watershed Structure And Gene Flow For Columbia Spotted Frog Populations In Southwestern Montana[TWS]

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Beaver have long been recognized as animals with a unique ability to strongly alter their environment. In southwestern Montana, historical pressure on beaver populations has altered the hydrology of many watersheds. At the same time, amphibian populations that depend on lentic habitat might be declining. Whereas multiple factors are clearly behind these declines, habitat fragmentation due to the loss of beaver-created habitat may be one of them. Although research has shown a link between diversity of aquatic fauna and beaver activity, a landscape comparison of population connectivity for a species using beaver-created habitat has not been attempted. This study contrasts watersheds with and without beavers to investigate possible differences in habitat composition and configuration for pond breeding amphibians. We queried a database consisting of hundreds of randomly selected watersheds developed for monitoring lentic amphibian distribution to examine the type, number, and distances between water bodies serving as potential breeding sites for Columbia spotted frogs. To test the relative importance of beaver-created lentic habitat for gene flow within and between populations of Columbia spotted frogs, we selected three pairs (beaver and non beaver) of watersheds, and genetic and habitat data from all known breeding sites were collected. Individual samples were analyzed at six microsatellite loci and estimates of population connectivity were inferred based on the number of shared alleles.

Veterinary Interventions, Management, And Conservation Of The Black Rhinoceros In Zimbabwe[TWS]

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Wild populations of black rhinoceros (*Diceros bicornis*) in Africa have suffered catastrophic declines over the past 3 decades as a result of illegal hunting for horn. The black rhino received CITES Appendix I listing in 1977. However, between 1970 and 1992, 96 percent (~63,000 animals) of the wild population was killed. Since the late 1990s certain populations have been showing signs of recovery with a total estimated wild population of 3610 in 2005. The Zimbabwean population suffered a correspondingly precipitous decline reaching a low of ~300 animals by 1992. A 2004 survey, however, revealed a population of 536. Conservation measures responsible for the current increasing trend, detailed in the Zimbabwe Black Rhino Conservation Strategy and instituted in 1992, include outreach and education, capture and translocation, dehorning, creation of Intensive Protection Zones, increased law enforcement, improved monitoring techniques, and establishment of a viable ex-situ population. Improved capture techniques and judicious use of long-acting neuroleptics have greatly improved the success of these programs, reflected in overall mortality rates associated with capture of < 1 percent. Some approaches have been controversial and

expensive and dehorning as a conservation technique was discontinued in 1996. The threat of poaching remains, however, and current conservation efforts remain at a low level due to political instability, lack of government support, and inadequate operating funds. It is proposed that sustainable utilization of the black rhinoceros through live sales and sport hunting would contribute significantly to rhino conservation by generating revenue suitable for reinvestment in conservation programs.

Relative Contributions Of Prey, Physical Condition, And Habitat Structure To Predation By Cougars And Wolves In Southwest Montana[tws]

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Vulnerability to predation resulting from direct or indirect effects of physical condition allegedly is a widespread phenomenon in predator-prey systems. Yet there is a paucity of empirical support for the putative linkage between predator detection and avoidance behaviors and relative or absolute body condition. We examined patterns of prey selection by sympatric cougars (*Puma concolor*) and wolves (*Canis lupus*) to determine (i) if prey killed by wolves were in poorer absolute physical condition relative to prey killed by cougars and (ii) if declining relative physical condition resulted in prey becoming risk-insensitive, thus making them more vulnerable to predation. Additionally, we assessed the role of vegetative structure in facilitating predation. Since 2003, we have documented prey characteristics and kill site attributes in the northern Madison range of southwest Montana. Mule deer (*Odocoileus hemionus*) were the primary prey for cougars, whereas elk (*Cervus elaphus*) were the primary prey for wolves. Wolves selected prey in relatively poor absolute physical condition compared to prey selected by cougars. However, declining relative condition in mule deer may have contributed to vulnerability to predation by cougars. Wolf kills occurred in habitat that was more reflective of the study area than cougar kills. These disparities suggest that patterns in species-specific hunting behavior and prey selection differ considerably, and prey likely forage in a risk-prone manner as physical condition declines.

Looking Back To See Our Future: Managing Bison In The Greater Yellowstone Ecosystem[tws]

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Bison management within and near Yellowstone National Park (YNP) has been a source of public controversy since the park was established in 1872. An early census in 1880 indicated that about 600 wild bison remained in YNP, and sport hunting became illegal in the park by 1883. Because of an intractable bison-poaching problem, the U.S. army managed Yellowstone from 1886 until 1918. By 1902 only 40-50 bison remained within YNP, so the herd was augmented with 21 bison from Texas and Montana herds. Introduced bison were carefully husbanded at holding facilities in Mammoth and the Lamar Buffalo Ranch. Until 1967 YNP's bison were intensively managed, which frequently included herding or transporting among various habitats within YNP to enhance genetics, distribution, and

demographics. When brucellosis was identified in bison in 1917, various attempts were made to eradicate the disease: (1) bison testing positive for brucellosis for several decades were sent to slaughter; (2) in the early 1960s bison testing negative for the disease were vaccinated; and (3) various culling measure were implemented that included transplanting bison testing negative for brucellosis to habitats outside of YNP or to commercial bison ranches. After 1967, when the National Park Service emphasized managing free-ranging bison through natural population regulation, all of these activities ceased. Despite 50 years of intensive manipulation and 30 subsequent years of minimal management that coincided with periodic culling outside the park, YNP's bison herd continues to thrive and now numbers > 4200 animals. Management applied to YNP bison over ~100 years has significantly impacted genetics, distribution, movements, and numbers of the present population. We thoroughly examined management history of YNP bison to identify future management tools. The robust nature of YNP's bison herd and its diverse genetic make-up offer an appropriate source for future restoration projects. Chronic presence of brucellosis is the only significant factor inhibiting use of YNP herds for restoration. We propose that modern testing and rigorous monitoring protocols be developed and tested to explore the feasibility of extracting brucellosis free bison from YNP. Removing bison from this robust population through quarantine procedures to establish new conservation herds is consistent with historical models of wildlife conservation, the history of restoration projects using bison and other wildlife from YNP, and a need to regulate numbers and distribution of bison in this system.

Assessing The Success Of Swift Fox Reintroductions On The Blackfeet Indian Reservation: Project Update[TWS]

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From 1998 to 2002, the Blackfeet Indian Nation and Defenders of Wildlife reintroduced 123 captive-reared swift fox on the Blackfeet Indian Reservation in Montana. Our current research project is directed at determining whether these reintroductions have established a self-sustaining population of swift fox on tribal lands. To obtain matrix-based growth rates for the fox population, we radio-collared > 60 animals and to date have known fates for 23 individual foxes. From 2003 to 2004 the fox population on the Reservation grew at a rate of 7 percent and projected growth for 2004-2005 was approximately 15 percent. Most swift fox mortality can be attributed to coyotes (57%) and raptors (22%). Also, because we thought that more releases might possibly be needed, we implemented a small mammal survey across the Reservation in an effort to estimate relative abundance of prey. During summer 2004, we placed 20 trap grids at random locations and captured 169 animals with deer mice (61%) and Richardson's ground squirrels (21%) comprising the majority of captures. This research project will be completed in autumn 2005.

West Side Story: Genetic Population Structure Of Elk Gangs In The Northern Rocky Mountains[TWS]

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Managing and conserving wildlife populations over large spatial areas challenge wildlife and conservation biologists to take new approaches. Large mammals, such as Rocky Mountain elk (*Cervus elaphus nelsoni*), exemplify this challenge because they have seasonal and annual ranges that cover areas the size of watersheds or sub-basins, respectively. To meet

this challenge of managing elk, we performed spatial analysis of populations at the landscape level using the metapopulation concept and a genetic analysis approach. We collected tissue samples of individual elk from across the northern Rocky Mountains and genotyped each individual using microsatellites at multiple loci. We examined genetic population structure with 5 approaches. Individuals were assigned to local populations based on their relative similarity or dissimilarity to each local population using genotypes and geographical location. Our results indicated little genetic differentiation between specific regions. Understanding the genetic population structure of elk from a metapopulation perspective provides both theoretical and practical benefits for managing and sustaining this species.

Assessing The Roles Of Nutrition And Habitat Selection In The Decline Of A Bighorn Sheep Population[TWS]

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Reintroduced populations often face the hazard of insufficient or inadequate habitat in their new range. Bighorn sheep herds in the Jacks Creek area of Owyhee County, Idaho, increased steadily from initial releases in the late 1960s until the early 1990s but have recently exhibited a precipitous decline. Habitat deficiencies, specifically inadequate forage or escape terrain, have been implicated as potential causes for this decline. We assessed the extent to which variation in use and availability of habitat resources across three drainages in the study area were correlated with variation in lamb production and ewe and lamb survival. Radio-telemetry indicated that females in each drainage represented distinct herds. Sheep in the herd exhibiting the highest lamb survival were more often located feeding at sites dominated by cliffs and shrubs, whereas sheep in the herd exhibiting the lowest lamb survival fed at sites dominated by loose rock and grass. Availability of rugged terrain did not differ between the two drainages. In 2003, fecal nitrogen content also differed significantly among herds; we obtained the highest mean value from the herd exhibiting the highest lamb survival. Analyses of arrangement, size, and interspersion of habitat patches are currently underway. Preliminary results suggest that selection of habitat features was related to lamb survival, and therefore may have played a role in this population's decline.

Distribution Of Pygmy Rabbit On Public Lands In Southwest Montana[TWS]

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Pygmy rabbit (*Brachylagis idahoensis*) records in southwest Montana date back to 1918 with the majority of the historical range occurring in Beaverhead County. Current distribution in Montana does not vary from historical distribution, but rabbits occupy different sagebrush habitat types than previously documented. Past studies focused on basin big sagebrush (*Artemisia tridentata tridentata*) habitat in drainages and swales that provide taller sagebrush structure and on deeper, friable soils at elevations of 4500 to 6700 ft. Recent survey efforts in Dillon Field Office (DFO) have documented pygmy rabbits ≤ 8000 ft in mixed sagebrush habitat types of mountain big sagebrush (*A. t. vaseyana*), three tip sagebrush (*A. tripartita tripartite*), and Wyoming big sagebrush (*A. t. wyomingensis*) across the landscape in a variety of soils suitable for burrowing. Pygmy rabbit. We noted burrows and pellets while doing sage grouse habitat surveys during summers 2003 and 2004. In 2004 we began inventorying

habitat for which few records existed, or pygmy rabbits had not been documented in the past, to refine distribution maps. These inventories indicated a more widespread and common occurrence than was previously noted from surveys of the mid-1990s. Daubenmire and line intercept methods were used to characterize habitat for sage grouse and pygmy rabbits and determine shrub canopy cover and vertical structure. Pygmy rabbit occurrence in this area appeared more dependent on sagebrush structure and patchiness rather than on species composition.

The Montana Challenge: Remaining The Last Best Place For Fish And Wildlife In A Changing West[TWS]

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Montanan's relationship to fish and wildlife, and their ties to the natural landscape, are defining characteristics of the state and its people. From our long-time ranchers in their sturdy pick-up trucks to today's emergency-room nurses riding titanium-framed bicycles, we all seem to know times are changing. To better understand the shifts and changes in Montana's cultural and economic landscape, 30 years of disparate economic, social, demographic, recreational, political, and legal information was compiled. The information shows that a new and important economic engine is operating along side the state's established commodity-based industries. For today's Montanans, who are fueling the state's growth and economic vitality, the West's natural landscapes and fish and wildlife resources are proving to be a key consideration in where to live and how to make a living. The challenge for wildlife managers is to recognize the opportunities this new social and economic sector represents to conservation while maintaining, restoring, and conserving the natural landscapes that create it.

Spatial Dynamics Of The Central Yellowstone Bison Herd: Use Of A Road System And Travel Network[TWS]

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The topic of winter recreation in Yellowstone National Park (YNP) has presented many controversial wildlife management issues. At the forefront of the debate is the effect of road grooming—done to facilitate over-snow vehicle travel—on bison (*Bison bison*) ecology. Bjornlie and Garrott (2001) conducted a two-year study from 1997-1999 on YNP's central bison herd and concluded that groomed road use by bison on the Madison-Gibbon-Firehole (MGF) winter range is neither sought out nor avoided and that roads are not a major influence on bison ecology—results contrary to popular belief. As an extension of Bjornlie and Garrott's (2001) research, data were collected from November to May from 1999-2004 on bison movements, road travel, distribution, and behavior in the MGF. In addition, daily snow water equivalent (SWE) estimates and related covariates were modeled at 28.5-m spatial resolution from 1997 to 2004. We assessed causes of temporal variation in bison travel—both

on-and off-road—by evaluating competing hypotheses to determine the relative contributions of snowpack, road grooming, density-dependence, and forage accessibility on magnitudes of travel. Using multiple linear regression output and model comparison techniques, the best-supported models indicated that road travel is positively affected by SWE and the number of bison in the MGF but negatively influenced by road grooming. Likewise, bison density-dependence and SWE variability positively affect the magnitude of off-road travel. Our findings coincide with Bjornlie and Garrott (2001) that suggest that a suite of abiotic and biotic factors positively affected bison travel rather than road grooming.

Canada Lynx And Wolverine: Five Years Of Conservation[TWS]

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Canada lynx (*Lynx canadensis*) were listed under the Endangered Species Act (ESA) in March 2000 as threatened. Wolverine (*Gulo gulo*) were petitioned and determined to be not warranted for federal listing in August 2003. Independent of these different legal histories, national interagency conservation programs for these 2 species have been handled in a similar fashion by state and federal agencies with management responsibility. The Lynx and Wolverine Steering Committee, consisting of state and federal members, continues to provide oversight for the conservation of these 2 carnivores. For Canada lynx, a nationwide management document entitled, Canada Lynx Conservation Assessment and Strategy (LCAS, August 2000) provides guidance for project design in mapped lynx habitat. Conservation Agreements among USDI Fish and Wildlife Service, USDA Forest Service, and USDI Bureau of Land Management provide guidance for the interim period between the LCAS and its incorporation into agency management plans. Lynx have been surveyed across their historic range in the lower 48 states and found to exist in 5 primary areas. For wolverine, there are 2 teams developing a conservation strategy and science report. Research is underway in selected areas of historic wolverine range. We summarized conservation programs and status of both species on public lands in the contiguous United States in relation to species status, ongoing management programs, and research. Potential threats and future conservation needs for both species and habitats were presented.

Natal Dispersal Of Juvenile Pygmy Rabbits: Preliminary Results[TWS]

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Natal dispersal is an important aspect in maintaining wildlife populations. Habitat fragmentation and a tendency for populations to exhibit local extinctions make knowledge of dispersal capabilities of pygmy rabbits (*Brachylagus idahoensis*) critical for conservation planning. However, due to logistical constraints, natal dispersal has not been studied in pygmy rabbits. We studied movements of juveniles from shortly after emergence from

natal burrows (May-July 2004) through early January 2005 as part of an ongoing study of juvenile dispersal. We trapped 12 males and 14 females at approximately 0 to 4 weeks post emergence. We attached 1-g glue-on radio transmitters to fur between the shoulder blades. Glue-on transmitters were replaced with 5-g radio collars after juveniles reached body mass of ~300 g. Individuals were radio-tracked twice/week until mid August, after which rabbits were tracked once every two weeks. Preliminary data suggested that both male and female juveniles tended to be relatively sedentary until about 6-8.5 wks of age when many made rapid long-distance movements ranging from 0.8 to 6.2 km for males and 2.9 to11.8 km for females. However, movements of several juveniles of both sexes during that time period were ≤ 200 m. Median natal dispersal distances for males and females >8.5 weeks of age were 1.1 and 4.8 km, respectively. Mortality rates for males and females through January 2005 were 67 and 64 percent, respectively. Although preliminary, these results indicated that pygmy rabbits regularly disperse farther than previous movement data suggest, increasing the potential for connections among populations.

Chronic Wasting Disease: National And State Implications[TWS]

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Chronic wasting disease (CWD) has affected wildlife management programs nationwide. In some states, allocation of expenditures for CWD management has been detrimental to funding other important wildlife management programs. The presence of CWD in a state may also reduce hunter participation thereby reducing the effectiveness of one of wildlife management's most effective tools, the big game hunter. The long-term effect of CWD on wildlife populations is still being evaluated. While Montana has not found CWD in its free ranging wildlife populations, we expect surveillance efforts at some point to identify the disease within our borders due to our proximity to states and provinces where CWD has been diagnosed. What is the current state of knowledge about CWD: its distribution, pathology, epidemiology, transmission, management, and control? What is Montana FWP doing to prevent CWD or to prepare to manage it when it is found within our borders? Current results from national and state surveillance programs as well as considerations for management of CWD were presented.

Bison Demography In Yellowstone National Park 1902 To Present[TWS]

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Once nearly extirpated across its range, the population of American bison (*Bison bison*) in Yellowstone National Park (YNP) has increased from just 22 animals in 1902 to > 3000 in modern times. This conservation success came about as a result of shifting management paradigms to correspond with population size of the bison herds. Park managers initially used intense animal husbandry practices to foster herd growth. As herd size increased, the USDI National Park Service implemented a free-range system of management known as natural regulation. Most recently, several agencies employ periodic removals when bison leave park boundaries and come into conflict with local livestock operations. Today, we have over a century of bison population information on the Northern and Central herds. We analyzed 47 years of ground count data together with 51 years of aerial count data to investigate changes in population growth rates. We used piecewise log-linear analysis of count data to estimate

the population growth parameter λ during periods of uninterrupted growth, and we used a series of ratio estimators to estimate λ during periods in which frequent removal occurred. We also examined effects of snowfall, summer precipitation, and elk population numbers on population growth rates of bison. Our research provides a context to interpret controversial bison movements outside the park and demographic evidence that bison have changed their spatial use patterns within YNP.

Identification Of Functional Corridors With Movement Characteristics Of Brown Bears On The Kenai Peninsula[TWS]

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We describe a technique to identify functional corridors using animal movement characteristics across a landscape. We use GPS locations from brown bears (*Ursus arctos*) on the Kenai Peninsula to illustrate the technique. We derived movement density, movement speed, and angular deviation of movement from paths drawn between locations and use a cluster analysis to classify the landscape into non-habitat, primary habitat, and corridors. We examined differences among landscape types with a classification tree. We assess the influence of frequency of locations and scale on the number and size of corridors identified. This corridor identification technique will help managers move beyond the theoretical discussion of corridors and linkage zones to management of landscape features to preserve connectivity.

Why Did The Turtle Cross The Road? Consequences Of Habitat Fragmentation On A Painted Turtle Population[TWS]

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Human-induced fragmentation of landscapes is a major threat to species conservation. Highways and other road systems can affect wildlife populations directly through highway mortality and indirectly through habitat loss and decreasing habitat connectivity. Semi-aquatic turtles are especially vulnerable to this type of fragmentation because they use terrestrial landscapes for nesting and seasonal movements but have limited abilities to move effectively across the landscape. Although it is widely believed that freshwater turtles have declined in abundance due to habitat loss and fragmentation, few quantitative studies have documented such a relationship. I'm studying the effects of human-induced fragmentation on a population of western painted turtles (*Chrysemys picta bellii*) in a wetland ecosystem in the Mission Valley, Montana. Fragmentation is likely to increase given pending reconstruction of U.S. Highway 93, which bisects this network of wetlands. Current effects of the highway on turtle population demography and connectivity are unknown. I characterized demographics of the turtle population by estimating pond-specific abundance, sex ratios, and stage-class structure. To gain an understanding of the level of connectivity, movement patterns and road mortality rates will also be examined. Summarizing all 3 yrs of fieldwork (2002-2004), I marked a total of 2302 individuals and have recorded >10,200 captures. All individuals were

measured, weighed, tagged, and released into the original pond of capture. I've recorded 841 males, 783 females, and 678 juveniles (sex undetermined). Preliminary results of the road mortality data indicated 1043 turtles were killed during the study.

Impacts Of Tourism On Behavior And Demography Of Olympic Marmots[TWS]

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Relatively little is known about the impacts of hiking and other recreation on small mammals, whose size and life-history may constrain their responses to disturbance. We tested for effects of recreation pressure on survival and reproduction in Olympic marmots (*Marmota olympus*), a large ground-squirrel that has disappeared from several areas of high human activity levels. We assessed the degree to which anti-predator and foraging behavior and demographic rates differed between heavily visited and unvisited sites. Marmots at heavily visited sites displayed behavioral signs of habituation; they allowed hikers to approach significantly closer before retreating to their burrows, and remained in their burrows for less time after disappearance of hikers. During two-minute focal observation periods, heavily visited marmots looked up more often while foraging although length of each look was the same as that seen in unvisited marmots. By foraging longer, visited marmots did not appear to compensate for this difference. In support of the assumption that energy intake is not limited by human disturbance, marmots at both types of sites had comparable reproductive rates and were in similar body condition as measured by seasonally adjusted body mass. Survival rate estimates for radio-tagged marmots appeared only slightly higher at the low-visitation sites. All these results are consistent with the hypothesis that marmots adjust their behavior to accommodate current levels of tourism without incurring a demographic penalty; however, the possibility that high visitation may decrease marmot survival rates should be investigated further.

Bat Use Of Highway Bridges In South-Central Montana[TWS]

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Bat use was evident at 78 of 130 highway structures examined during summer 2003 in Carbon, Stillwater, and Yellowstone counties, Montana; 66 were used apparently exclusively for night roosting, and 12 were day roosts. Use of highway structures was widespread among highway categories (Interstate: 73.2%, Primary: 47.2%, Secondary: 57.1%, Local/State Maintained: 60.0%). Day roosts were found in all system categories, but relatively more so in the Local/State Maintained category, and all maternity colonies (4) were in this category. Use of bridges and intensity of use at night roosts were generally unrelated to landscapes within 3 km (1.86 mi) of structures. Only mean percent forest cover was significantly greater around day roost structures, but substantial overlap among unused, night roost, and day roost categories indicated the pattern was a trend and not the major influence on structure use by bats. All day roosts were found within 8 km (5 miles) of riparian corridors. Bats used 75.9 percent of concrete structures, 37.5 percent of steel structures, and 31.6 percent of wooden

ones. Day roosts were not found in steel structures; three of four maternity colonies were in wood bridges. Slab bridges were the least preferred concrete spans. Day roosting sites in concrete bridges included accessible expansion joints between cast-in-place and T-beam bridge sections, the longitudinal slots on the underdeck of parallel box-beam structures, and the space between two abutting bridge lanes. Day roosts in wood bridges included the narrow space between parallel girders, and spaces between wood supports under the deck where railing posts were anchored.

Development And Application Of A Mass Estimation Method: Weddell Seals As A Case Study[TWS]

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In contrast to terrestrial systems where abundance of food resources of large predators is generally easily monitored, food resources of large marine predators are difficult to monitor. As a surrogate measure of marine predator food availability, researchers have used both direct and estimated measurements of body morphometrics and mass. However, subsequent uses of estimated mass measurements have failed to explicitly incorporate error variance around estimated values. Using the Weddell seal (*Leptonychotes weddellii*) population in Erebus Bay, Antarctica, we present development of a mass estimation method and techniques that incorporate prediction error variance around mass estimates. The equipment and procedures were developed for estimating mass of Weddell seals by taking morphometric measurements from digital photographs. Mass measurements were collected following initial photographic sampling so that regression models correlating known mass with photogrammetric measurements could be built. To select the model with the narrowest prediction intervals, we used predicted sum of squares (PRESS) as the model selection criteria. Resulting regression models predict mass of adult female seals to within ±13.8 percent of estimated mass, and ± 25.9 percent of estimated mass for pups. Differences in mass transfer between 7 experienced and 3 inexperienced maternal females and their pups were successfully tested using explicit incorporation of prediction error variance around mass estimates. We suggest that future use of mass estimations should include prediction error variance and that these techniques be used to explore links between variation in population parameters of the McMurdo Sound Weddell seal population and environmental variation.

Evaluation Of Hunter Management Strategies Utilized By Montana's Block Management Program[TWS]

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The Block Management Program, initiated in 1985, was implemented to encourage private landowners to provide free public hunting access. Currently, the program is very successful with >1200 landowners enrolling >8.7 million acres, and providing > 400,000 hunter days of free public hunting. Surveys were sent to 423 landowners (303 returned) and

1636 hunters (976 returned) to evaluate current perceptions of block management area (BMA) users. Preferences, expectations, and satisfaction levels were determined by calculating frequencies and means using SAS 8.2. Landowners were satisfied with permission methods used, numbers of hunters received annually, and hunter limit and travel restriction rules utilized, but satisfaction levels differ when comparing relative game abundance and harvest success between geographic regions. Hunters are very successful in gaining permission to BMAs and are satisfied with travel restrictions encountered, but satisfaction levels differ when comparing amounts of other hunters seen, game abundance, and harvest success between BMA types and geographic regions. Program success is evident by levels of satisfaction with various hunter management tools evaluated by this study, but some areas need improvement. This study identified management strategies that should be continued and strategies that can be improved on existing BMAs. It also provided insight for designing strategies that meet specific preferences and expectations of program users when developing new BMAs. Implementing these findings will allow the Block Management Program to become an even greater success in providing free public hunting access to private land than it is today.

Developing A 4-H Wildlife Program In Montana[TWS]

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There is no existing wildlife habitat educational program offered to Montana youth. Montana 4-H'ers excel in livestock raising and judging, sewing, foods, demonstrations, and even skateboarding. Unfortunately, the state with the greatest wildlife diversity in the lower 48 has a very under-developed wildlife program. Nationally, 30 states have participated in the 4-H Wildlife Habitat Evaluation Program (WHEP), a program currently unavailable to Montana youth. The MSU Extension Wildlife Program has received a number of e-mails and telephone calls indicating a need for a well-developed wildlife program offered through the framework of Montana 4-H. In June 2004, a state committee was formed to address this concern, and the result is the Montana 4-H Wildlife and Habitat Education Program. Montana 4-H WHEP will help youth strengthen self-concepts and character through interaction with other young people. It will teach essential life skills such as oral and written communication, critical thinking, teamwork and decision-making. Montana 4-H WHEP will foster relationships between professional wildlife and fisheries biologists, volunteers, parents, youth, teachers, farmers and ranchers. The mission of Montana 4-H WHEP is *...to foster critical thinking and development of life skills through exposure of various concepts of wildlife management, including: wildlife biology, population management and habitat requirements and enhancement.*

Wildlife Abundance In Reponse To Leafy Spurge Control With Sheep[TWS]

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Although much research has been completed on impacts of cattle grazing on wildlife habitat, available information documenting effects of sheep grazing on wildlife habitat is limited. In cooperation with the Montana Sustainable Rangeland Livestock Task Force, the MSU Extension Wildlife Program began a long-term monitoring effort in 2003 to determine impacts on wildlife habitat and wildlife abundance in response to control of leafy spurge with

sheep. Data were collected during spring and fall of 2003 and 2004 at 3 locations. Each site consisted of a grazed and non-grazed area at which we sampled small mammal abundance with Sherman live traps in a mark-recapture protocol. Avian surveys were conducted from a fixed point at each site. Preliminary results indicated no differences in abundance of small mammals and birds after the first year of sheep presence. In 2003, leafy spurge was reduced by an average of 61 percent in areas where sheep grazed. Vegetative data will also be used to evaluate forage availability for large ungulates. Although sheep grazing has been demonstrated to be an effective and economical means of controlling leafy spurge, what effect this may have on wildlife habitat remains unclear. Trends in wildlife populations will not become apparent immediately following grazing by sheep as native plant communities may take years to recover after removal of an invasive weed.

Carnivore Conservation Trust: A Model For Joint Private-Government Funding To Conserve And Manage Carnivores In North America[TWS]

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Wayne D. Owens (D-Utah), (deceased).

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Support for restoring and conserving carnivores within wildland areas of Canada, the U.S., and Mexico is significant, and many citizens value carnivores as an integral part of ecosystems. Despite this support, cost of recovery and management of carnivores is increasingly difficult for federal, provincial, and state wildlife agencies, and discretionary funds for wildlife including imperiled species have declined. Firearm sales proceeds allocated for traditional big game management and research on harvestable populations used for non-game wildlife including protected carnivores has met resistance from wildlife officials, and hunting constituencies in states and provinces where large wildland enclaves for managing wide-ranging and rare carnivores remain intact. For carnivore conservation to succeed, we believe funding must be consistent and comprehensive in scope, address practical problems and solutions that sustain and conserve both humans and carnivores, be capable of shaping and improving management policies over time, and be equitable to diverse community interests. To enjoin public support with federal, provincial, and state efforts for carnivore research, management, and public education, we propose a joint private-government stamp for meeting carnivore conservation costs. We suggest this effort be modeled similar to the conservation program for waterfowl in Canada and the U.S., e.g. North American Waterfowl Management Program, and be international in scope. We use geographically separate wolf conservation efforts across the United States, Canada, and Mexico to elucidate how funds from a Carnivore Trust and Conservation Stamp could be generated from joint private-public investments and applied to carnivore conservation and management in North America.

Conservation Of Native Canada Lynx In Northwest Wyoming: Promise And Pitfalls Of Agency Management[TWS]

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Canada lynx (*Lynx canadensis*) were listed in 2000 as a threatened species, owing in part to a lack of provisions in agency land management plans for lynx protection and conservation. Effective implementation of the Endangered Species Act (ESA) depends heavily upon commitment of federal agencies to enforce its provisions. We evaluated implications of ongoing and proposed timber sales and recreation management on a Canada lynx subpopulation on the Bridger-Teton National Forest in the Wyoming Range of northwestern Wyoming. Although distant from established lynx populations, historical records and distributional patterns suggest that lynx in the Wyoming Range represent an indigenous but geographically isolated population that persists, in part, as a consequence of past selective harvest of stands that were 'tie-hacked' in the early 1900s. Using a LANDSAT vegetation image and relocations of radio-collared lynx (1996-2002), we examined patterns of lynx habitat use and assessed changes to vegetation due to timber harvest. We suggest that past selective timber harvest (tie hacking) was important in developing late successional forests that mimic vegetation structure and characteristics found in boreal environments that appear important to lynx. We also detail consequences of continuation of traditional timber practices that reduce habitat for lynx and their prey. We identify shortcomings of USDA Forest Service management that impede wildlife laws and policy, erode ESA effectiveness, and weaken science-based resource management. We recommend steps for improving lynx conservation on public lands.

Assessing Grizzly Bear Population Status At An Ecosystem Scale[TWS]

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We describe preliminary results from a 2004 study to estimate the size and describe distribution of the grizzly bear (*Ursus arctos*) population from hair samples found on 31,400 km2 (7.75 million ac) in northwestern Montana. Microsatellite analysis of the hair will be used to identify individual bears for use in a mark-recapture population model. We employed two methods concurrently to sample bear hair. We used a 7x7-km grid to systematically distribute 2564 baited hair snag stations. The second approach included repeated hair collection visits to a network of 4750 bear rub trees, sign and fence posts, and power poles along trails and roads. No lure was used to attract bears to rub objects. During 4- to 14-day capture sessions, we collected 20,782 hair samples from baited sites. Collections from rub objects yielded 12,906 hair samples. Extensive fieldwork and logistical planning were required the previous year to prepare for the large sampling effort. Dedicated quality assurance staff worked with field crews to ensure consistent application of field protocols. We describe strategies for working at large scale, such as that 1) methods of coordinating

activities among the federal, state, tribal, and private entities involved with an ecosystem-scale project, and 2) procedures used during data collection and genetic analysis prevent, detect, and/or correct errors. We also discussed challenges and recommendations for directing 200 widely dispersed field employees and conducting fieldwork on extensive tracts of private property in remote areas where communication is often limited.

The Effect Of Snow Compaction On Coyote And Lynx Winter Ecology[TWS]

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Coyotes (*Canis latrans*) and Canada lynx (*Lynx canadensis*) are sympatric throughout much of the lynx's southern range. Researchers and managers have suggested that presence of compacted snowmobile trails may allow coyotes to access lynx habitat in winter from which they would have otherwise been excluded by deep, unconsolidated snow. This could then allow coyotes to more effectively compete with lynx for snowshoe hares, the lynx's primary prey, throughout the year. We investigated how coyotes interacted with compacted snow trails by conducting carnivore track surveys and snow tracking radio-collared coyotes in areas having both documented lynx presence and moderate levels of recreational snowmobile use. Coyotes generally remained in lynx habitat under deep snow conditions (>1 m) from January through March. Coyotes traveled an average of 368 m from compacted snow trails while randomly generated and located tracks in the same areas averaged 339 m from compacted snow trails. Coyotes were primarily scavengers in winter and feed sites were no closer to compacted snow than random expectation. Coyotes neither demonstrated a strong spatial affinity for compacted snowmobile trails nor did they prey heavily on snowshoe hares. Compacted snowmobile trails unlikely facilitated increased exploitation competition between coyotes and lynx for snowshoe hares on our study area.

Urban Wildlife: A Montana Oxymoron?[TWS]

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Expanding residential development into previously uninhabited wild and agricultural habitats has created situations in many Montana cities and towns where wildlife populations have adapted and thrived in numbers leading to numerous human-wildlife conflicts. Issues run the gambit of denuded landscape vegetation and vehicle-animal collisions to outright physical confrontations between wildlife, pets, and people. These situations present a number of problems and challenges to conventional methods of wildlife management and also raise public safety issues. In 2004 the Urban Wildlife Working Group (UWWG), comprised of FWP staff from across the state, city officials, and interested citizens, was formed with the aim of developing a framework upon which urban wildlife conflicts could be addressed. The primary focus of the Group was deer and associated property damage, vehicle collisions, human safety, and disease issues. Although other species were considered, deer were of the most immediate concern. The group suggested that proposed management options and policies for urban deer management also had potential to effectively manage other species of wildlife. This presentation will focus on the roots of urban wildlife issues, how they have been approached in Montana as well as other locales across the nation in the past and the findings and recommendations of the Urban Wildlife Working Group.

Highway Crossing And Mortality Patterns Of Black Bear For Wildlife Passage Planning In Northwest Montana[TWS]

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Our understanding of the effects of highways on wildlife connectivity is limited due to a lack of detailed data on animal movements within transportation corridors. Prior to highway construction in my study area, we used hourly locations from GPS collars to (1) analyze spatial and temporal characteristics of crossing locations, (2) compare crossing frequencies to traffic volumes and crossing speeds to average speeds, (3) compare crossing behavior among classes of bears, and (4) assess the spatial distribution of crossing, road-kill, and planned passage locations. Results indicate that adult females and subadult males crossed highways more frequently than adult males. Both food-conditioned and non food-conditioned bears crossed highways, but food-conditioned bears crossed more frequently. Logistic regression analyses revealed that the odds of a bear crossing was more likely (1) at night, 2) near stream intersections and areas with higher stream density, (3) in open habitat areas closer to cover or areas with a higher percentage of cover within 200 m, and 4) closer to human development. Crossing activity was highest when movement rates were lowest and negatively correlated with traffic. Speed during crossings was higher than during non-crossing times. Crossing and road-kill locations were clustered. Crossings were significantly closer to road-kill and planned passage locations than random locations. Highways served as a partial barrier to wary bears, which crossed seldom-to-none, but were fully permeable to food-conditioned bears, which crossed frequently. Food-conditioned bears, however, carry a higher mortality risk due to an increased likelihood of management removal or vehicle collision.

Factors Affecting Survival Of Female Greater Sage Grouse In South Phillips County, Montana, 2001-2004[TWS]

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Populations of greater sage grouse (*Centrocercus urophasianus*) have declined by 69-99 percent from historic levels. We radio-collared 237 female sage grouse and measured 426 vegetation plots at 4 sites during 2001-2003 on a 3200-km^2 landscape in north-central Montana. We examined the relationship between hen survival and a suite of landscape-scale habitat and environmental conditions. Program MARK was used to model monthly survival rates for 11 seasonal intervals as influenced by a variety of habitat and environmental explanatory variables. Hen survival varied by season within years and by year within seasons. Nesting hens have higher breeding-season survival than non-nesting hens, and individuals at one site had lower hunting-season survival than at other sites. Although we presume hen

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survival to be high and vary little relative to other galliforms, we observed considerable variation. Process variation was 0.255 with an expected range of annual survival of 0.12-1.0. The ratio of process to total variation was 0.999, indicating that observed variation was real and not attributable to sampling variation. We observed a 4-fold difference in maximum and minimum annual survival, ranging from 0.96 for nesting birds in 2001-2002 to 0.24 for non-nesters in 2003-2004. Low annual survival in 2003 reflects compounded effects of a West Nile virus outbreak in August and a severe winter of 2003-2004. Increased hen mortality associated with severe winter weather contrasted with a prior belief that sage grouse populations are typically unaffected by winter weather conditions and underscores the importance of protecting winter sagebrush habitats.

Factors Influencing Nest Survival And Productivity Of Lewis's Woodpeckers Breeding In Aspen Riparian Woodlands[TWS]

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We initiated a study in 2002 to determine factors influencing nest survival and productivity of Lewis's Woodpeckers (*Melanerpes lewis*) breeding in aspen riparian woodlands in south-central Idaho. Lewis's Woodpecker, a sporadically distributed but often locally abundant species, breeds primarily in burned pine and riparian forests throughout the western United States. Although information is available on reproductive success and productivity in burned pine and cottonwood habitats, importance of aspen riparian woodlands as breeding habitat has not been explored for this species. Whereas aspen woodlands are used to a lesser degree than other habitats, they provide valuable breeding habitat for this species throughout the Intermountain West. We determined nest fate, i.e., fledge or failure, for 76 nests monitored during the breeding seasons of 2002-2004. We constructed an a *priori* model list to assess covariate(s) that best explained nest survival. We modeled daily survival rate of nests as a function of several covariates including nest initiation date, nest age, year, weather, nest site characteristics, and a linear time trend using a generalized linear models approach. The model receiving the strongest support indicates nest survival decreased for nests initiating late in the season and increased with increasing minimum daily temperature. High overall nest survival (74%) and high nest productivity (2.3 fledglings/successful nest, $n = 59$ nests) suggested that aspen riparian woodlands may provide potential source habitat for Lewis's Woodpecker.

Common Loon Breeding Ecology And Population Status In Northwest Montana[TWS]

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Approximately 200 adult common loons *(Gavia immer)* migrate to northwest Montana each spring from wintering grounds on the Pacific Ocean. They produce an average of 30-50 chicks each spring. Rapid increases in lakeshore development and recreation activity on many northwest Montana lakes prompted Montana Fish, Wildlife and Parks to list common loons as a sensitive species. Loons are habitat specialists, thus lakeshore development and recreation may be leading to decreased nesting opportunities and lower loon chick production on area lakes. Biologists and managers from state, federal, and private entities joined to form the Common Loon Working Group. Their goal was to coordinate population monitoring and guide research and management activities. State Wildlife Grant funding was awarded to fund research in an effort to better understand relationships between physical lake characteristics, human use factors, and loon nesting ecology. An ongoing loon-banding program has also been initiated in Montana. Preliminary results regarding nest success, chick survival, and lakes monitored were presented. Hypotheses concerning effects of development and recreation activity on nest success and chick survival were discussed. Significant observations from the loon banding project including breeding and wintering re-sightings as well as plans for future research in Montana were presented.

Prairie Dog Conservation In Montana: Past, Present And Future[TWS]

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Coordinated prairie dog conservation began in Montana during the mid 1980s with a survey of prairie dog colonies in eastern Montana and publication of an annotated prairie dog bibliography in 1986 by the Montana Black-footed Ferret Working Group (MPDWG). These actions were undertaken with a desire to manage prairie dogs for re-introduction of the endangered black-footed ferret. In response to the social and biological complexities of prairie dog management, the Montana Prairie Dog Working Group was formed in 1996. Participants in the MPDWG include the full spectrum of viewpoints on prairie dogs (state and federal agencies, tribal representatives, business people, private landowners, non-governmental organizations). The MPDWG worked collaboratively to develop the prairie dog conservation plan for Montana (2002) and continues to support implementation of this plan. Current efforts and accomplishments include a local prairie dog planning effort in NC and NE Montana, developing a statewide prairie dog monitoring strategy and a feasible landowner incentive program, and establishing a Translocation Protocol guiding all future translocations of prairie dogs. The USDI Fish and Wildlife Service issued a finding of "warranted but precluded" for the black-tailed prairie dog in February 2000 and removed the species from further consideration for listing in 2004 under the Endangered Species Act (ESA). A petition

to list white-tailed prairie dog was deemed "not warranted" in 2004. In the face of concern about implications of listing under the ESA, widely divergent perceptions of prairie dogs as either destructive pests or ecosystem engineers, and declines of species that are associated with prairie dog colonies, the MPDWG continues an interesting, collaborative effort to promote prairie dog conservation. A discussion of the history of prairie dog conservation and associated social, biological, and political challenges were presented.

Snowshoe Hare Fecal Pellet Deposition And Disappearance Rates Near Seeley Lake, Montana[TWS]

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We investigated fecal deposition and disappearance rates of snowshoe hare (*Lepus americanus*) in the Seeley-Swan area of western Montana to evaluate whether the deposition rate was comparable across forest types (diets), years, and seasons, and whether the disappearance rate was comparable over the landscape. These rates may be contributing to the variation causing low precision when the Krebs method is applied in Montana, and affecting the power of regression analysis to predict estimates of population densities. Weak locally-derived equations compromise the validity and generality of an assumed strong relationship between hares and pellets at the southern extension of their geographical range. We collected depositional data from 49 captive hares and found mean daily production was similar between diets (western larch [*Larix occidentalis*], Douglas-fir [*Pseudotsuga menziesii*]) and years (2002-03, 2003-04) but was differed ($P \leq 0.025$) between seasons (summer, winter). An adult hare feeding on either diet, regardless of year, deposited 575 ± 108 (mean ± 1 SD) pellets/day during summer and 467 ± 82 pellets/day during winter. We monitored pellets in the field and found the disappearance rate between pellet types (summer, winter) differed ($P = 0.020$), but disappearance was similar across the landscape within a pellet type. From October 2002 to August 2003, 90 percent of both pellet types remained, while 57 percent of summer pellets and 72 percent of winter pellets remained at the last count in June 2004. This information has influential implications for implementing the Krebs protocol and performing regression analysis, and advances in hare research benefit its specialist predator, the threatened Canada lynx (*Lynx canadensis*).

The Impacts Of The Forest Highways Program On Wildlife And Wildlife Habitat: A Growing Threat[TWS]

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We believe the Federal Highway Administration's Forest Highway Program will have serious, ongoing detrimental impacts on wildlife, fisheries, and ecosystems across public lands in the west and operates contrary to ongoing efforts to assure healthy ecosystems. About 29,000 mi of State and local roads are designated as Forest Highways in the United States. The Forest Highway Program is promoted to provide "safe and adequate access to and through National Forest System (NFS) lands for visitors, recreationists, resource users, and

others that is not met by other transportation programs." The term "Forest Highway" means a forest road under the jurisdiction of, and maintained by, a public authority and open to public travel. Forest Highways are to "assist ...economic development and promote tourism and travel." The 2003 budget for Forest Highways was $162.4 million. USDA Forest Service Chief Dale Bosworth identified 4 threats to national forests and grasslands: (1) fire and fuels, (2) invasive species, (3) loss of open space, and (4) unmanaged recreation. The Forest Highways Program will directly contribute to increases in all these categories. Motorized access management is one of the most contentious issues in public land management. The impacts of Forest Highway Program paving and "improvement" on public lands will (1) increase traffic and traffic speeds, increase recreational impacts through developments like campgrounds, (2) increase direct wildlife and fish mortality due to increased human presence, and (3) fragment populations and habitats. Impacts will be more serious where public lands are intermingled with private lands. Paving forest roads in areas of intermingled ownership will likely increase subdivision, with all its well-known problems, as people find it easier to commute to and from homes on high-speed, paved roads. We suggest that application of the Forest Highways Program be reconsidered. We believe that this program and funding for this program should properly be viewed as a threat to healthy ecosystems and healthy wildlife communities rather than a benign program to assist rural and community economic development.

Factors Influencing Wildlife Use Of Underpasses And Culverts Along I-90 In Western Montana[TWS]

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Underpasses and culverts have potential to mitigate negative impacts of roads by maintaining connectivity between populations and decreasing wildlife collisions with vehicles. Knowledge regarding factors affecting wildlife use of highway crossing structures allows managers and planners to make informed decisions regarding highway mitigation efforts. Using heat and motion sensitive cameras, we monitored 7 underpasses and 3 culverts for 1 year along Interstate 90 (I-90) in western Montana. We assessed wildlife use of crossing structures in relation to surrounding variables such as human presence, topography, and distance to hiding cover. We obtained 1658 wildlife photos at underpasses and 52 photographs of animals in culverts. Primary users of underpasses were ungulates, 3 black bears, and 5 coyotes. Although terrain funneled ungulates toward underpasses, ungulate use of underpasses was not related to human structures or hiding cover. Infrequent carnivore use at underpasses may indicate that they use crossing structures opportunistically.

How Does Harvest Mortality Affect Sage Grouse Population Dynamics?[TWS]

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Sage grouse (*Centrocercus urophasianus*) have been extirpated in five states and one province, and their populations have reportedly declined over the remainder of their historical range. Many studies have been conducted to determine rates of reproduction and survival, but the effects of hunting on population dynamics of sage grouse has been less studied. Both additive and compensatory mortality hypotheses have been suggested as factors affecting harvest mortality rates of sage grouse, but compelling evidence for either hypothesis is lacking. To assess the effect of harvest on population dynamics and the relationship between harvest and these competing hypotheses, we began radio-marking and monitoring sage grouse on two sites, one open and one closed to hunting, in south-central Montana during spring 2003. We have been monitoring the level, timing, and, whenever possible, the causes of female mortality from spring through the end of hunting season each year. We also monitored reproductive effort and success in these birds to allow us to compare productivity between the two sites, which will especially be of interest should we find evidence that density was reduced by harvest on the hunted site. Results to date were presented regarding levels of female mortality during hunting season, breeding effort and success, and overall mortality of females during the first 2 of 3 years of study. Useful future research regarding the effects of harvest on sage-grouse populations was discussed.

From Lemons To Lemonade: The State Of Gray Wolf Conservation And Management In Montana[TWS]

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This winter marks a milestone. Ten years have passed since gray wolves were reintroduced into Yellowstone National Park and the central Idaho wilderness. Whereas biological criteria for recovery in the northern Rockies have been met or exceeded since 2000, approved management plans are required from Montana, Idaho, and Wyoming in order for the USDI Fish and Wildlife Service (USFWS) to propose delisting. Lack of an approved plan from Wyoming postpones delisting. Meanwhile, wolf numbers and distribution in Montana and across the northern Rockies have expanded since the early 1980s, both due to natural recolonization in northwest Montana and immigration from Yellowstone National Park and central Idaho. The State of Montana has begun taking advantage of provisions in federal

regulations that make it possible for Montana Fish, Wildlife and Parks (FWP) to become a designated agent of the USFWS. In finalizing cooperative agreements for the northwest Montana "threatened" area and the "experimental" area across southern Montana, FWP has begun implementing as much of the state's approved wolf conservation and management plan as allowed by federal regulations. Making lemonade symbolizes the beginning of the transition from a federal species recovery effort to long-term conservation and management led by FWP and eventual delisting.

Movements Of Lynx At Multiple Scales In Northwest Montana: Preliminary Results[TWS]

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The future of the Canada lynx (*Lynx canadensis*) likely rests on multi-scale management for healthy and connected populations. To best direct such management, we are studying lynx movement at local and landscape scales with the following objectives: 1) describe lynx dispersal in terms of extent, timing, and crossings of natural and anthropogenic barriers; and 2) determine how lynx movements correlate to changes in local and landscape scales of habitat pattern. In 2003 we supplemented our studies in Seeley Lake, Montana with a new study area in the Purcell Mountains of northwest Montana. After first delineating the local distribution of lynx based on snow-track surveys, we deployed two forms of satellite telemetry to monitor lynx movements across spatial scales. Dispersal is a landscape-scale phenomenon that we are studying with ARGOS-based satellite telemetry, allowing us to remotely track dispersal movements. Currently, only ARGOS collars are suitable (110 g) for tracking kittens (9 month-olds). During the winter of 2003-2004, we instrumented 10 lynx kittens across both study areas with ARGOS collars; we are currently deploying additional ARGOS collars in 2005. To track local movements, we deployed a lightweight (~200g) store-on-board, GPS collars. In 2004, we tested this technology by deploying and retrieving data from collars placed on 2 males this winter. Preliminary data suggest GPS collars will provide lynx location data of greater quality and quantity than previously possible. We are currently deploying additional GPS collars on lynx in 2005.

Elk Use Of Forage And Cover In Response To Wildfire And Severe Snow Conditions[TWS]

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Managers lack ecological context for applying recent experimental evidence that penned, fed elk (*Cervus elaphus nelsoni*) in northeastern Oregon did not benefit from forested thermal cover during winter. We offer additional context, based on measures of cover and forage use by a wild, free-roaming elk population from 1988 through 2004 on the Blackfoot-Clearwater Wildlife Management Area in western Montana. A 2250-ha wildfire in October 1991 and severe winter in 1996-1997 allowed us to assess the effects of stochastic variation in forage

availability and energy costs of foraging. Predictable availability of forage and space during early winter in the rangeland vegetation type was more important than non-forest shrub and forest types in shaping the normal winter home range of this elk population. However, herbaceous and shrub forages in non-forest types were most vulnerable to decreasing availability due to deep and/or crusted snow during the course of most winters, which was not alleviated with forage enhancement (e.g., the 1991 burn). Elk were confined to forest types throughout the severe winter. We posit that energy costs of foraging play an overarching role in determining the use of habitat components by wintering elk, and that forest stands are important to mitigate for a normal range of environmental restrictions in forage availability. We recommend forest management practices on elk winter ranges that maintain and recruit a mix of shade (to minimize snow crusting), snow intercept, understory forage, lichen production and litter-fall, and microsite components of thermal cover such as large-diameter boles and dense thickets.

Wolf Den Site Selection In The Northern Rocky Mountains[TWS]

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Because mortality of wolves (*Canis lupus*) is highest during the first 6 months of life, den site selection may affect reproductive success of wolf populations. We studied fine-scale denning habitat selection ($\leq$ 100 m of den sites) by comparing field-measured characteristics of 22 dens in Idaho, Montana, and Canada with paired random contrast sites within pack home ranges. In order of importance, wolves denned in areas that had greater canopy cover, hiding cover, herbaceous ground cover, and woody debris, and were closer to water than paired random sites. These factors suggest selection for physical protection and a readily available water source around den sites. We also compared 35 wolf dens to 35 paired contrast sites in Idaho, Montana, and Yellowstone National Park with respect to 6 remotely-sensed variables (elevation, slope, coniferous forest cover, solar radiation, distance to water, and distance to roads). We found no significant ($P < 0.10$ univariate) contrasts in the remotely-sensed variables, suggesting that some important variables can only be measured in the field. Nonetheless, a multivariate model based on the Mahalanobis distance with 4 of these remotely-sensed variables slope, elevation, coniferous forest cover, and solar radiation suggests that > 85% of dens will occur in potential denning habitat that occupies < 12 percent of the wolf recovery areas in the Northern Rocky Mountains. These results suggested optimal wolf denning habitat might be a limiting factor.

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The Efficacy Of Using Snow Tracks In Providing Genetic Data From Wolverine And Other Carnivores[TWS]

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Collecting noninvasive genetic samples from putative wolverine (*Gulo gulo*) snow tracks is an effective method for providing definitive species identification and more complex demographic data. We completed 54 backtracks and collected 169 hairs and 58 scats. Amplification rates of mitochondrial DNA (mtDNA) used for species identification were 74 and 24 percent for scats and hairs, respectively. Average distance to a collect a sample containing high quality mtDNA for species identification was 1331m. Genetic analysis confirmed 35 snow tracks (64%) as wolverine. The remaining 19 snow tracks consisted of 8 that did not provide samples and 11 that contained nonamplifiable samples. Collection of both hairs and scats provided 28 percent more track verifications than would have only one type of sample. We analyzed nuclear DNA (nDNA) from the same samples to produce individual genotypes. Amplification rates of nDNA from scats and hairs were 52 and 16 percent, respectively, and produced individual genotypes for 23 of the 54 snow tracks (43%). These results confirmed that snow tracking to collect noninvasive genetic samples can be used to verify species identification from snow tracks detected through any winter survey method, as well as to perform more complex monitoring such as minimum population estimates, tests of relatedness, or mark re-capture population estimates if sample sizes are large enough. While tested on wolverine, this method could be applied to other carnivores that live in snowy regions and are active during the winter months.

West Nile Virus And Sage grouse: An Update[TWS]

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Greater sage grouse have been extirpated from much of their original range, and population declines are typically associated with loss and degradation of sagebrush habitat. West Nile virus (WNv) was first detected in the Powder River Basin in 2002. In July and August 2003, we confirmed 17 WNv mortalities among radio-marked female sage grouse across four sites in Alberta, Montana, and Wyoming. During that period, adult female survival declined an average of 25 percent at WNv-infected sites compared to pre-WNv years (1998-2002), whereas no decline was observed at a site without WNv in western Wyoming. Comparisons of lek counts between impacted and unimpacted sites in the Powder River Basin indicate a pronounced local population decline in the affected area between 2003 and 2004. In 2004 WNv mortality was reported from Colorado, Wyoming, Montana, and California, although WNv mortality rates in the PRB appear to be lower than in 2003. To date, over 350 live or harvested sage grouse have tested negative for WNv, suggesting that sage-grouse have little innate resistance to WNv infection. Small, isolated populations of Gunnison sage grouse

(*C. minimus*) in Colorado and Utah and greater sage grouse in California, Utah, Washington, Alberta, and Saskatchewan may be at highest risk. If man-made surface water facilitates the spread of WNv, new debate will arise over how to best manage such activities in arid western landscapes. The emergence of WNv intensifies debate over how to best maintain large areas of high-quality habitat needed to support robust populations capable of withstanding catastrophic outbreaks of disease.

Multi-scale Factors Related To Snowshoe Hare Densities In Fragmented Forests[TWS]

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Habitat needs of snowshoe hares (*Lepus americanus*) have been examined extensively at scales as large as forest stands, but few data exist to suggest how landscape composition and configuration affect hare populations. We explored how the surrounding forest matrix affected snowshoe hare densities in patches of suitable habitat using fecal pellets to index hare density. Using a multi-scale modeling approach, models that included a combination of landscape- and stand-level variables performed better than single-scale models, demonstrating a marked effect of matrix characteristics on snowshoe hare pellet density. Stand-level variables, especially sapling and medium-sized tree density, were the best univariate predictors of snowshoe hare pellet density, but pellet densities were also positively associated with the amount of boreal forest and the degree of landscape heterogeneity within 300 m of a patch of suitable hare habitat and negatively correlated with the amount of open-structured forest at that scale. Our results stressed the importance of stand-level vegetative factors, yet add an understanding of the extent to which the matrix affects snowshoe hare densities. Resource managers should consider the matrix, striving for greater heterogeneity, more boreal forest, and less open-structured habitat, when snowshoe hare densities are a concern.

A Cat Race Tail...of Houndsmen, Biologists, Administrators, Committees And Lawmakers In Northeast Montana— A History Of Montana Hb 142[TWS]

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Cougar hunting has been part of the fabric of northwest Montana's hunting heritage for over 100 years. From the late 1970s to the mid -1990s cougar populations increased dramatically throughout western Montana. Along with cougar population increases, the number of houndsmen and cougar hunters coming to northwest Montana from out of state increased as well. Popular press magazines were advertising northwest Montana as a destination cougar hunt for non-resident hunters. The high number of non-resident hunters that subsequently came to northwest Montana, in part, created challenges for Montana Fish, Wildife and Parks' (FWP) existing cougar management. Harvest quota management, allocation of the recreational opportunity, and quality of the hunting experience were issues

that both houndsmen and FWP staff raised. A potential solution presented itself in the form of a new Montana statute that became known as House Bill 142. The trials and tribulations of implementing a new law and subsequent hunting season regulations were explored in detail for this presentation. Following the implementation of Montana HB 142, hunting season quota over-runs decreased, percent nonresident harvest decreased, and opportunity for resident cougar hunting increased. This was accomplished over a two-year period by people dedicating countless hours at regional and statewide houndsmen, advisory, legislative, FWP Commission, and public meetings.

Behavioral Responses Of Elk To The Threat Of Wolf Predation: Sex-Specific Constrains[tws]

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We studied individual and herd-level behavioral responses of elk to spatial and temporal variation in the risk of predation by wolves over three winters in the Upper Gallatin drainage, Montana. We tested whether responses to risk were affected by body condition by measuring marrow fat levels of bulls and cows and relating differences in condition to differences in antipredator behavior and predation rate. Overall, elk responded to the presence of wolves by substantially decreasing group size and moving into or close to timber. In contrast to this general pattern, bull-only groups were smaller than average, and slightly increased in size in the presence of wolves. As a consequence, bull-only herds and mixed sex herds converged on a similar size when wolves were present. Individual vigilance levels were not correlated with herd size or distance to timber and were weakly correlated with individuals' position within the herd. Bulls were in worse body condition than cows throughout the winter, and condition deteriorated for both sexes as winter progressed. Vigilance in cows, but not bulls, increased in response to wolf presence, that indicated responses of bulls may have been constrained by condition. For cows, increases in vigilance produced a significant decrease in time spent grazing although bull grazing time was not affected by wolf presence. Some bulls moved into timber when wolves were present. Bulls were overselected by wolves, and cows were underselected. We conclude that bulls were less able to pay the foraging costs associated with the antipredator responses of cows.