

BIOLOGICAL SCIENCES - TERRESTRIAL

COYOTE AND WOLF COEXISTENCE IN NORTHWESTERN MONTANA^{TWS}

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Recolonizing wolves (*Canis lupus*) may affect congeneric coyotes (*C. latrans*) by altering food habits, social behavior, movements and habitat use. We examined the effects colonizing wolves have on coyote populations in northwestern Montana. Home ranges for eleven coyotes were distributed between the two wolf pack territories and on the edge of the territories, and minimally overlapped with core wolf areas. Although dietary overlap was high between the canids, food partitioning by size and age occurred. Wolf presence may be beneficial to coyotes as a source of additional food through scavenging, but it also appears that the wolves are affecting coyote distribution and survival.

STATISTICAL TESTING IN WILDLIFE RESEARCH^{TWS}

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Wildlife researchers overuse statistical hypothesis testing. A test can only help to determine if a difference or effect exists. A test does not provide any information on the importance, size, or direction of the effect. Most of the time, wildlife researchers are not interested in the presence or absence of an effect, but in estimating the size of an effect they know exists. The appropriate statistical tool is the confidence interval.

HIGH ELEVATION MUSHROOM COMMUNITIES^{MAS}

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Wild mushrooms are often perceived as appearing randomly or haphazardly in various locales, but like plants and animals, most fungal species have a preference for certain habitats and form recognizable communities. An ongoing survey of Rocky Mountain mushrooms shows that fungal communities of this montane region are unique in many respects, and some appear limited to the western U.S. Communities of high elevation habitats include: alpine mushrooms, snowbank mushrooms (dependent on snow melt-water), mushrooms of boreal conifer forests, burn fungi (which fruit after forest fires), mushrooms of quaking aspen forests, and fungi of

disturbed areas (avalanche paths, previous smelter sites, etc). These macromycete communities are discussed in terms of the species involved, the ecological roles of fungal guilds, the global distribution of these types of communities, and the dynamics of how mycofloras change through disturbance and succession. Specific examples of community types from western Montana are emphasized. The preservation of this macromycete biodiversity depends on the conservation of these habitat types and the promotion of uneven age forests.

**MAPPING FERRUGINOUS HAWK NEST SITES USING GIS AND GPS -
SIMPLE WAYS TO MAP WILDLIFE POINT FEATURES^{TWS}**

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New GPS and GIS equipment and software have become affordable to many wildlife professionals, yet barriers to the use of new techniques limit their use by management biologists. One of the barriers is the lack of time to learn how to use complex equipment and software. I will describe how I used an inexpensive Garmin GPS unit and ArcView to map ferruginous hawk nest sites and other wildlife point features. The Garmin GPS 45 unit was used with an external antenna taped to the overhead bar of a Supercub airplane to track the flight path of aerial surveys and mark locations of ferruginous hawk nests. The track and waypoint files, with locations recorded as UTM coordinates, were downloaded into a computer, then imported into dBase III Plus. These files were brought into ArcView and overlaid on base layers that were projected into the UTM coordinate system. The system enabled generation of a map depicting the areas surveyed and the nests located, within 1 hour of the completion of the flight. Flight time near nests was minimized by elimination of the need to circle around the nest area while attempting to locate the nest on a map. Uncorrected GPS locations were accurate to within approximately 100 to 300 meters (depending upon satellite configuration and selective availability), which is sufficient for aerial locations from an airplane. This system is adequate for much of the survey work conducted by wildlife management biologists, yet simple enough to be used without extensive training in GIS software.

**BLACK-TAILED PRAIRIE DOG ABUNDANCE AND TRANSLOCATION EFFORTS
ON CHARLES M. RUSSELL NATIONAL WILDLIFE REFUGE^{TWS}**

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Prairie dogs (*Cynomys spp.*) continue to decline from historic times as a result of agricultural cultivation, eradication programs and sylvatic plague (*Yersinia gesfis*). In 1997 the US Fish and Wildlife Service began a translocation program to re-establish black-tailed prairie dogs (*C. ludovicianus*) on previously "plagued-out" colonies

located on the Charles M. Russell National Wildlife Refuge (CMR) in southern Phillips County, north-central Montana. Successful translocations should speed prairie dog re-colonization and provide habitat for endangered black-footed ferrets (*Mustela nigripes*) and species of concern such as mountain plovers (*Charadrius montanus*), burrowing owls (*Speotyto cunicularia*) and ferruginous hawks (*Buteo regalis*). Seven release techniques involving various cages and holding pens and 1 passive technique using augured holes were evaluated during initial trials and 2 were selected for 1997 translocation efforts; 1) a chicken wire pen containing augured holes, and 2) augured holes without any containment. A total of 330 prairie dogs were translocated, 281 from other CMR colonies and 49 from a dog colony at Fort Harrison, Helena, Montana. The CMR prairie dogs were released at 4 sites, 2 with the chicken wire pen method and 2 at augured hole only sites on the Manning Corral prairie dog colony where no old burrow openings were present. The Fort Harrison prairie dogs were released at one site on the Big Snowy prairie dog colony where old burrow openings were still present. Prairie dogs were observed on all 5 sites 60 days post release and some are assumed to still be there based on presence of active burrows and fresh diggings. All releases appear successful, but observations this spring and subsequent reproduction and colony growth will help determine the most efficient techniques.

**BIGHORN SHEEP POPULATION DYNAMICS ON THE
BEARTOOTH WILDLIFE MANAGEMENT AREA, MONTANA^{TWS}**

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The dilemma of bighorn sheep (*Ovis canadensis*) die-offs has plagued wildlife biologists and managers for decades. Many states have established augmentation programs in an effort to counteract such die-offs and maintain viable sheep populations. I studied the population dynamics of a reintroduced bighorn sheep herd on the Beartooth Wildlife Management Area in west-central Montana. After a decade rapid growth, this herd experienced a major disease-mediated die-off in 1984 and has subsequently been unable to recover to pre die-off densities. Primary study objectives included evaluation of sheep reproduction and mortality, habitat use, and disease. Particular emphasis was placed on determining the role of predation in sheep population dynamics. Additionally, transplanted individuals were monitored to evaluate the effectiveness of two augmentation projects (N=39 sheep). Results from this study will provide insight into the post die-off population dynamics of small sheep herds and improve our understanding of augmentations and the degree to which they actually assist in population recovery.

USING CLIMATIC DATA TO DEVELOP AN INDEX OF
WINTER SEVERITY AND RESPONSES BY LARGE MAMMALS^{TWS}

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Daily climatic data are obtained by Natural Resources and Conservation Service (NRCS), SNOTEL stations and National Weather Service (NWS), and climatological (CLIM) stations. SNOTEL sites are usually in mountain locations in western US and provide near-real time, year around, daily data on snow water equivalent (SWE), precipitation, maximum, minimum and average air temperatures (TMAX, TMIN, TAVG). CLIM sites are usually at valley locations and provide daily precipitation, TMAX, TMIN, TAVG and snow depth (SNWD). After all missing data are estimated by correlation with nearby sites, daily SWE and snow density are estimated at CLIM sites using precipitation, SNWD and TAVG. The Keetch/Byram drought index (KBDI), a soil moisture deficit model, and accumulated growing degree days are also computed. The Index of Winter Severity (IWS) for each winter range is calculated using SWE for the snow index, minimum temperatures below the effective critical temperature for each species for temperature index, and KBDI and growing degree-days for the winter forage index. The snow, temperature and forage indexes are weighted and combined to provide an IWS on a scale from +4 for the mildest of historic conditions to -4 for the most severe conditions. The IWS is one of the factors relating to mortality, reproduction and predation of big game animals. Accumulation of SWE on summer and transitional ranges is related to migration to winter ranges. Winter temperature, forage and SWE are related to declines in fat reserves and winter mortality.

EVALUATION OF THE "PEEPER" VIDEO PROBE TO EXAMINE BURROWS AND SUBSURFACE ACTIVITY OF BURROWING MAMMALS^{TWS}

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We used the "Peeper" video probe (Christensen Designs, Manteca, CA) to examine burrow structure, complexity and use by pygmy rabbits (*Brachylagus idahoensis*) and black-tailed prairie dogs (*Cynomys ludovicianus*) in southwestern Montana. The probe proved useful on pygmy rabbit burrows but of little use on prairie dog burrows. Utility of the probe on different burrow types is described. Advantages and disadvantages of the current technology are recorded. We attempted to locate pygmy rabbit maternity burrows or nests, and determine occupancy rate but were unsuccessful. However, the probe was useful for pygmy rabbits and we learned a great deal about burrow structure and complexity without excavation. Fifteen rabbits (both *B. idahoensis* and *Sylvilagus nuttallii*) were observed in burrows and behavioral response to burrow intrusion recorded. No other vertebrate species were observed. Due to limited mobility, not every burrow could be completely examined. Prairie dog burrows were deep, steep and penetrated rocky soils. Thus, mobility of the probe and cable length were not suitable for examining prairie dog burrows.

RECENT STUDIES OF SNOW-URINE SAMPLES FOR EVALUATION OF ELK NUTRITION^{TWS}

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Over the past 7 years a group of collaborators have been investigating the possible utility of using urinary allantoin:creatinine ratios as an index of nutrition in Rocky Mountain elk. Research has included both controlled experiments with captive elk at the Starkey research facility in Oregon as well as studies of free-ranging, radio-collared elk in the Madison-Firehole herd of Yellowstone National Park. The captive animal studies have demonstrated a strong linear relationship between dietary intake of metabolizable energy and urinary allantoin:creatinine ratios. The relationship appears to be quite robust to different nutritional regimes and responds quickly to changes in dietary intake. Intensive sampling of free-ranging, radio-collared cow elk in Yellowstone over a 6-year period indicate that the urinary ratio exhibits pronounced seasonal and annual variation that can be correlated to changes in forage quality, due to plant senescence and green up, and quantity, due to changes in snowpack. Annual differences in mean overwinter allantoin:creatinine ratios were also correlated with overwinter calf survival. These data suggest that allantoin:creatinine ratios derived from snow-urine samples may be useful as a research tool for studying overwinter nutrition when the identity of the animals depositing the urine is known. We found significant differences in urinary

allantoin:creatinine profiles. among sex-age classes that could limit practical management applications that would require collection of anonymous snow-urine samples. A sampling and analysis protocol to alleviate these problems was developed and tested on 6 elk herds in Wyoming and Montana during the winter of 1996-97. Results of this study suggest that the urinary ratio may have promise as a management tool as well, however, additional research will be needed.

DEMOGRAPHIC CONSEQUENCES OF BROWN-HEADED COWBIRD PARASITISM ON LAZULI BUNTINGS^{TWS}

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Lazuli buntings (*Passerina amoena*) breed throughout the western United States and southwestern Canada in a wide variety of habitat types. Although previous studies have suggested that Lazuli buntings are not experiencing problems on the breeding grounds, my research indicates that 80 - 100% of Lazuli bunting nests are parasitized in many habitats throughout the west. I investigated the demographic consequences of parasitism for Lazuli bunting populations with age structured Lefkovich matrix models. Current estimates of survivorship and fertility indicate that, in the absence of parasitism, Lazuli bunting populations have lambda values (geometric rate of population growth) just slightly greater than 1 (the break-even point). These models suggest that parasitism rates of about 15% or higher decrease the growth rate of bunting populations below 1. Hence, it is unlikely that many bunting populations are self-sustaining. Metapopulation models using GIS models are used to investigate the conservation implications of different management options.

A SOURCE SINK MODEL OF LAZULI BUNTINGS IN MONTANA^{TWS}

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Although Lazuli buntings (*Passerina amoena*) are currently widely distributed in the western US and southwestern Canada, parasitism by brown-headed cowbirds (*Molothrus ater*) is extremely high in many populations. Such populations do not appear to be self-sustaining. To examine spatial structures of potential source and sink populations of Lazuli buntings, we developed GIS models of Lazuli bunting and brown-headed cowbird distributions for the state of Montana. These models suggest that Lazuli buntings may be more vulnerable to cowbirds than currently appreciated. Of the 4,375,746 ha identified as potential Lazuli bunting breeding habitat, 97% falls within areas with a high risk of cowbird presence (possible sink habitats), and <1% occurs in areas with no cowbirds (possible source habitats). Furthermore, Lazuli buntings breed in habitats that occur in configurations that make them especially vulnerable to cowbirds: patches tend to be small (>90% of patches are <10 ha) with

high edge to interior ratios, and are generally surrounded by habitats that could support livestock and thus cowbirds.

ABUNDANCE OF SNAGS IN WESTERN MONTANA FORESTS^{TWS}

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Standards for snag retention and recruitment in managed forests are often based on models of species specific habitat requirements. If maintenance of the entire biota is the goal, an ecosystem approach, using historic patterns as a guide, may be more appropriate. I used plot data from the USFS continuous forest inventory program to characterize the abundance of snags from western Montana forests. I classified plots by whether or not they had a history of timber harvest, as well as by dominant species and habitat types. I characterized snag abundance by dbh class and species. On unharvested plots, total snag (9"+) density varied from under 3/acre on dry Ponderosa pine (*Pinus ponderosa*) types to approximately 24/acre on mesic spruce and fir types as well as warmer sites supporting grand fir (*Abies grandis*) and western red cedar (*Thuja plicata*). Abundance of large (21"+) snags was much lower but showed similar trends, varying from as low as 0.45/acre on dry Ponderosa pine sites and 0.19/acre on lodgepole pine (*Pinus contorta*) dominated sites, to 2.07/acre on warm, mesic sites. Snag abundance on young, recently disturbed stands was lower than on older, sawtimber stands. However, snag dynamics differed from those of live trees during the process of stand aging. Unharvested stands had higher mean snag abundance than those with a history of timber harvest. I interpret the generally higher snag abundances in uncut stands to reflect not only an unharvested condition, but also a lack of fire, and probably an attendant excess of mortality from insects and disease. Such influences would be manifested more strongly in smaller, than larger dbh classes. Thus, snag abundances in the larger dbh classes of these uncut stands should closely resemble those that would generally occur on the landscape in the absence of intervention by mechanized mankind, if accounting for a small upward bias caused by fire suppression. These latter figures can be used as rough targets for landscapes where managing for biodiversity or emulating natural disturbance patterns is an important objective. I also offer suggestions for snag retention/recruitment guidance in regeneration harvest units.

**CAVITY NESTING BIRDS IN SALVAGE LOGGED
AND UNLOGGED POST-FIRE FORESTS^{TWS}**

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Practices of wildfire suppression and salvage logging of burned forests have prompted concern among biologists for fire-associated bird species in the northern Rocky Mountains. Therefore, in May 1997, we initiated a five-year study to examine the responses of cavity birds to salvage logging of recently burned forests. Here, we present an overview of the study and some highlights from the first field season. Three of our four study areas burned in 1994 and portions of each were subsequently salvage logged. The fourth area, which was not logged, burned in 1996. We systematically searched all study areas for nests and then monitored nests to determine reproductive success. We also measured habitat characteristics of nest sites and random sites. Nest searching efforts in all areas identified 140 occupied nests of 13 cavity nesting species. Of all cavity-nesting species in our study, Black-backed and Three-toed woodpeckers and brown creepers had the strongest affinity for nesting in unlogged forests; >80% of nests were found in unlogged portions of burned forests. The nests of hairy woodpeckers, Northern flickers, and mountain bluebirds were found in equal numbers in logged and unlogged areas of burned forests. Small numbers of Lewis' woodpecker, Williamson's sapsucker, and American kestrel nests primarily were found in the logged areas. Preliminary data suggest that post-fire forests, which are salvage-logged, provide nesting habitat for some cavity-nesting species. However, the suitability of nesting habitat may be markedly decreased for the two fire-associated species, the black-backed and three-toed woodpecker.

IN HEAT ON THE RANGE—THOSE SEXY MONTANA ELK!^{TWS}

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Elk breeding behavior and time of mating have received increasing attention. Photoperiod, physiological condition, and age of cows, age structure and availability of bulls and human disturbance are factors believed to influence the timing of conception. Late breeding is believed to result in lowered calf survival and consequent management implications. Crown-rump measurements of elk embryos from cow elk harvested during late season hunts provided data about the timing of breeding and other aspects of reproduction. Sixteen samples (n=11- 248) of elk uteri

were collected from 6 locations in Montana between 1982 and 1994. A total of 1324 embryos were examined to determine breeding date distributions, fetal sex ratios, and twinning rates. Comparative data from 2 earlier Montana samples were also examined. Conception dates ranged from August 27 to November 11. The mean conception date for all Montana embryos was September 26. Of adult cows 250 conceived by September 20 and 95% by October 12. Sample means ranged from September 19 through October 4. Conception date distributions were positively skewed and leptokurtic and did not indicate late or disrupted breeding patterns. Conception date distribution for yearling cows was significantly later than for other age classes. Only 0.52% of the uteri contained twin embryos. The overall the sex ratio was 115 males:100 females, but varied between samples.

ABUNDANCE AND NESTING SUCCESS OF CAVITY-NESTING BIRDS IN UNLOGGED AND SALVAGE-LOGGED BURNED FOREST PATCHES^{TWS}

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Three years of post-fire censusing for cavity-nesting bird (CNB) nests was conducted in a northwestern Montana forest which had been partially salvage-logged. Over all three years, nest density was consistently higher in unlogged patches (27.18 - 48.33 nests/40ha) vs. salvage-logged patches (7.74 - 21.43 nests/40 ha). Diversity of CNB species was higher in unlogged patches with 19 species nesting there compared to only seven nesting in salvage-logged patches. Cavity trees were marked and re-checked each year. Cavity re-use rates were higher in salvage-logged vs. unlogged patches. Habitat characteristics thought to be important in determining suitable nest trees were measured at active nests and at random trees. Tree species, tree size (DBH and height), tree status, and tree density were all important habitat characteristics for most species. Nesting success was monitored in unlogged and salvage-logged patches for one breeding season for the three most common species (Northern flicker (*Colaptes auratus*), Mountain bluebird (*Sialia currocoides*), and house wren (*Troglodytes aedon*). Northern flickers had significantly higher daily survival rates in unlogged vs. salvage-logged patches. The trend was similar for Mountain bluebirds, but the difference was not significant. House Wrens did equally well in either treatment type. Surprisingly, none of the habitat variables measured correlated with either successful or failed nests. Other factors were likely responsible for lowered nesting success in salvage-logged patches. Identifying, ideal nesting habitat for cavity-nesting birds may help mitigate future salvage logging activities.

THE STATUS OF ELK HABITAT PROJECT^{TWS}

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The Status of Elk Habitat Project began with the 1996 publication of Status of Elk in North America, 1975- 1995 by the Rocky Mountain Elk Foundation (RMEF). While this publication depicted elk populations, it did not assess elk habitat. In the spring of 1997, the RMEF and Geodata Services, Inc. initiated the Status of Elk Habitat Project. The objective of the project is to develop eight base layers that display the status of elk habitat across North America. The process involves using existing maps and habitat data when possible, instead of creating new data. The RMEF and Geodata are working with professional state, federal, and tribal wildlife specialists in a collaborative effort to map general summer and winter range, crucial summer and winter range, migratory corridors, parturition areas, and other important habitat features. The wildlife managers will also assign key limiting factors to each of the habitat polygons. Other data layers, such as land ownership, major roads, census geography, administrative stewardship, RMEF projects and management plans can also be added. Upon completion, the data will be available to Project cooperators throughout the United States and Canada.

PRODUCTION AND SURVIVAL OF ELK CALVES IN RESPONSE TO HABITAT IMPROVEMENT IN NORTHWEST MONTANA^{TWS}

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The purpose of this study was to determine elk pregnancy rates and calf survival from habitat enhancement. Habitat mitigation was completed in the area on elk winter range in the spring of 1996. I followed approximately 25 collared cow elk and their calves per year over a 2-year period to gather baseline data on pregnancy rates and calf survival. Pregnancy was determined through fecal analysis, and calf survival through observations and capture. Forty-year harvest trends show a possible decline in elk population in the Southfork of the Flathead River around Firefighter Mountain. We speculate that there are lower pregnancy rates in the Southfork as compared to other Rocky Mountain ecosystems. This may be because of alternate year breeding, summer or winter habitat quality, weather conditions. Over the two years of my study, we did see a difference in calf production and survival, however, weather conditions may have been a factor.

COMMON LOON MANAGEMENT IN MONTANA—AN UPDATE^{TWS}

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Common loons (*Gavia immer*) have been monitored in northwestern Montana since the early 1980's. The number of summer residents has remained relatively constant through this period, at about 200. Approximately 60 pairs attempt to nest with 24-26 pair successfully raising 1-2 chicks each year. Beginning in 1988, nest sites on lakes prone to high human recreational activity were protected by floating signs, which formed voluntary closures to help the public stay an adequate distance from the nest. The use of these signs resulted in a significant increase in the number of 2 chick broods produced and their use continues to present. Extensive public education occurs in the area of the lakes with signs so that the public understands the reason for the closure. This has resulted in high levels of compliance. In 1996 a banding program began in which loons were uniquely color-marked in hopes of determining the frequency of territory/partner changes, survival rates of 3 year olds returning to natal lakes, distance of dispersal from natal lakes, and the location of wintering sites. Blood and feather samples were taken to examine the extent of mercury bioaccumulation. Use of these samples has been incorporated into continent-wide genetics and physiologic investigations. The latter has determined that loons are extremely sensitive to environmental loads of methylmercury and are excellent biosentinels for this heavy metal.

RELOCATION OF THE FORT HARRISON PRAIRIE DOG COLONY^{TWS}

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A 10 ha black-tailed prairie dog (*Cynomys ludovicianus*) colony at Fort William Henry Harrison in the Helena Valley was relocated to two new sites during the fall of 1997. Prairie dogs were relocated because of a multi-million dollar construction project planned for the Fort Harrison cantonment area which included the existing prairie dog colony. Prairie dogs were live-trapped and moved 1 km to a 1 ha disturbed grassland site located outside the development zone near the northeastern corner of Fort Harrison. Prairie dogs were also transported 500 km by vehicle to the Charles M. Russell National Wildlife Refuge (CMRNWR) and released at a prairie dog colony extirpated by a sylvatic plague epidemic during 1996. The Fort Harrison relocation site was mowed and fenced with 5x5 cm mesh wire fencing. The fencing was buried 45 cm below the soil surface and extended 90 cm above the soil. A total of 79 prairie dogs was captured and moved to the Fort Harrison relocation site during September 1997. Prairie dogs apparently were able to climb the enclosure fence or squeeze through the wire mesh. Prairie dogs were observed on several occasions

traveling on a gravel road back to the original colony. The greatest number of prairie dogs observed within the enclosure was 17, and five remained at the relocation site by December 1997. Groups of 33 and 16 prairie dogs were released at the abandoned CMRNWR colony during early and mid-October. Prairie dogs readily used abandoned prairie dog burrows and showed little tendency to move from the release site.

DYNAMICS OF RUSSIAN OLIVE INVASION AND COTTONWOOD FORESTS ON THE LOWER MARIAS RIVER^{MAS}

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Russian olive is an exotic tree used for wildlife and windbreak plantings in western North America. There is concern that Russian olive will replace native riparian forests resulting in a loss of biological diversity. We mapped the occurrence of Russian olive along the entire lower Marias River below Tiber Dam. We measured the size, density and age of Russian olive and cottonwood in sample plots in sandbar, low terrace and high terrace habitats at 19 randomly chosen sites along the lower river. Cottonwood establishment was restricted to lower terrace Sites, usually within 30 m of the river channel. Russian olive in all size classes occurs along the entire lower Marias River but is much more abundant in proximity to domesticated plantings. Russian olive establishes in moist, lower terrace habitat as well as under mature cottonwood on high terraces but was never observed in fresh sandbars with cottonwood seedlings. Seventy-seven percent of cottonwood trees in all size classes were damaged by beavers in low terrace habitat, while only 22% of Russian olives showed damage. Most beaver-damaged cottonwood were cut at the base, while damage to Russian olive was usually confined to one or two basal limbs. Beavers returned to harvest cottonwood in low terrace habitats at least every 2-3 years on average. Beaver use was lower in high terrace habitat with 41% and 2% of cottonwood and Russian olive respectively showing damage. The lower Marias River had large annual flow fluctuations and frequent flooding prior to construction of Tiber Dam in 1956. Since then flooding has been attenuated, and flows remain relatively constant throughout the year. Cottonwood recruitment that used to occur over large areas of the floodplain is now confined to a narrow zone along the channel. Beaver populations may have been enhanced by flow regulation that increases the number of potential den sites safe from flooding and severe drawdown. Beaver effectively prevent cottonwood from developing a mature canopy close to the river while having little effect on the continued invasion of Russian olive. Riparian cottonwood forests will eventually be replaced by Russian olive as old cottonwood die on upper terraces and young plants on low terraces are removed by beaver or shaded by the less palatable species. The decline of riparian cottonwood forests can be ameliorated by a return to more natural flow regimes, management of beaver populations, and not planting Russian olive near riparian areas.

BEARPROOFING SOLID WASTE CONTAINERS FOR GRIZZLY AND BLACK BEARS IN LAKE AND CASCADE COUNTIES, MONTANA^{TWS}

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Abstract: Grizzly bear (*Ursus arctos*) and black bear (*Ursus americanus*) access to garbage at solid waste transfer sites is a serious problem for wildlife managers, county officials, local residents, and bears. We present the design, installation, costs/operation, and politics associated with bearproofing two solid waste transfer sites. Between 1982 and 1992, we documented the removal of four black bears from the Porcupine disposal site in Lake County. During 1993, we documented five black bears and one grizzly bear using the Porcupine site. In 1994, we designed and installed an automatic, hydraulic lid system for the 42 cubic yard dumpsters. Since the system was installed in September 1994, bears have not gained access to garbage, and evidence of bears visiting the site has declined every year. In 1996, Cascade County designed a similar system and installed it at a site we identified as a major problem for black bears. We worked with county officials and attended local public meetings to discuss the advantages of bearproofing the transfer site. The modifications have resulted in cleaner and safer sites, and a large reduction in bears accessing garbage. We plan on expanding the program to include additional transfer sites throughout Montana.

BLACK-FOOTED FERRET UPDATE^{TWS}

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A minimum of 26 black-footed ferret (*Mustela nigripes*) kits from 12 litters were born in the wild during 1997 on the UL Bend National Wildlife Refuge, north-central Montana. The confirmed spring breeding population was 23 (11 males, 12 females). Twenty captive-reared ferrets were released during October, 1997 to augment this growing population and was the fourth year of reintroductions. These ferrets were released among a subset of residents to investigate how ferret density may impact movements, distribution and survival. Resident and newly released ferrets were monitored with telemetry from September through mid-November, 1997 on treatment and control areas. Ferret density on the treatment area was 3.5 times that of the control area. No significant differences in survival were detected between or within areas before or after captive-reared ferret releases. Investigations of the ultimate capacity of the UL Bend area to support ferrets are continuing along with efforts to determine when this population will become self-sustaining and be capable of producing wildborn kits for translocation to other sites.

**A WILDLIFE MORTALITY SAMPLE AND MARROW
FAT ASSESSMENT DURING A RECORD SNOWFALL
WINTER, NORTHWESTERN MONTANA^{TWS}**

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Carcasses (n = 114) killed during winter 1996-97 in the lower Clark Fork River drainage of western Montana were examined and assessed for condition by bone marrow fat index using visual rating and percent fat (dry/wet weight) rating methods. Species examined were bighorn sheep (*Ovis canadensis*) (n = 11), elk (*Cervus elanhas*) (n = 33), mule deer *Odocoileus hemionus*) (n = 3), and white-tailed deer *Odocoileus virginianus*) (n = 97). Sex, age, femur length, diastema, mortality agent, and parasites were recorded when available. Percent marrow-fat was analyzed on 53 specimens. Most (93%, n = 29) white-tailed deer that died before 15 February had > 20% marrow-fat, while 33% (n = 15) of those that died after 15 February had < 20% marrow-fat. There was a significant difference between percent marrow-fat for those deer that died during the first half of winter and those that died in the last half (p = 0.003, t-test). A majority (59%, n = 22) of white-tailed deer carcasses from mid-late winter had an inadequate marrow-fat visual rating. A total of 41 (36%) animals were < 1 year old (1 elk, 2 bighorn sheep, 3 8 white-tailed deer) and 14 (12%) were estimated at > 10 years old (1 elk, 13 white-tailed deer). Females (77%, n = 85) markedly outnumbered males (n = 26) in this sample (3 were unknown). Mortality agents were categorized as hunter wasted (1 %), predator (7%), road kill (87%), train-kill (4%), and unknown (1%). These data document the seasonal physical stress on a sample of wildlife in northwestern Montana during a record snowfall event and support the contention that weather conditions can have a dramatic impact on wildlife populations. Since this type of data have not been collected in this area prior to 1997, no comparisons can be made regarding physical health during less severe winter conditions. Efforts to collect such data in the future will be made when time and resources allow.

**DYNAMICS OF A ROUGH-LEGGED HAWK (*BUTEO LAGOPUS*)
COMMUNAL ROOST IN THE MISSION VALLEY, MONTANA^{TWS}**

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During the winters of 1994 -1998, I investigated the roosting ecology of Rough-legged Hawks (*Buteo lagopus*) in the Mission Valley of northwestern Montana. Nineteen hawks were radio-tagged during the winters of 1995- 96 and 1996 -97 from which I recorded a total of 320 day and 326 night locations. Radioed birds frequently used two major communal roosts, flying up to 20 km daily to and from foraging areas. The primary roost (Ronan roost) is located in contiguous Douglas fir (*Pseudotsuga menziesii*) | ponderosa pine (*Pinus ponderosa*) forest near the foothills of

the Mission Mountains, and according to radio telemetry, encompasses approximately 238 ha ($n = 133$; adaptive kernel 70% polygon). The high-use area (adaptive kernel 40% polygon) within the roost consists of moderately dense forest (canopy closure >75 %) and contains many interspersed houses. A maximum of 225 Rough-legged hawks were counted departing the Ronan roost (Feb 1995), and multiple counts of >150 birds occurred in three of the four years. A maximum of only 44 hawks were counted during 1995- 96. Among- and between-year differences in the number of hawks attending the roost appear to reflect changes in microtine numbers. Preliminary data on the age and sex composition of hawks departing the roost are similar to those recorded on daytime surveys throughout the valley; however proportionately fewer juveniles were observed departing the roost than were recorded in the valley. Current research will test several hypotheses concerning the adaptive significance of rough-legged Hawk winter communal roosting behavior.

**EFFECT OF STREAMSIDE DEVELOPMENT ON DISTRIBUTION AND
PRODUCTIVITY OF AMERICAN DIPPERS (*CINCLUS MEXICANUS*)
IN WESTERN MONTANA^{TWS}**

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Human development may play an important role in determining the distribution and success of organisms. Habitat specialists such as the American Dipper (*Cinclus mexicanus*), are particularly likely to be affected by alterations to their habitat. During 1996 and 1997, I examined the effect of streamside development on the distribution and productivity of dippers in the Bitterroot Valley of Western Montana. I surveyed 23 creeks, located and monitored 49 nests, and conducted extensive habitat analyses of dipper territories and non-use areas. Average dipper densities were 0.33 ± 0.12 pairs/km of stream during the breeding season. Dipper breeding territories were more likely to occur in less developed portions of streams. However, there was no significant difference between number of young fledged in developed vs. undeveloped territories ($P=0.264$). Water depth in dipper territories was significantly greater at the end of the breeding season than in non-use areas ($P=0.001$) suggesting dipper distributions may be affected by intensive de-watering of creeks for irrigation. The presence of bridges, which provide nest sites for dippers, have allowed dippers to colonize the lower reaches of creeks and nest in areas that may be more vulnerable to flooding and predation. However, there was no significant difference between number of young fledging from bridge vs. natural nest sites ($P=0.463$). Indeed, bridges at lower elevations allowed dippers to breed earlier and in some cases, to double brood. Overall, the most important factor in determining dipper distributions and productivity in the Bitterroot appears to be the availability of nest sites.

NEST DEFENSE BEHAVIOR IN SNOWY OWLS (*NYCTEA SCANDIACA*)^{TWS}

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In 1995 and 1996 at Barrow, Alaska, we studied the nest defense behavior of snowy owls at 73 nests. We recorded female flushing distance from the nest, and vocalizations, attacks, distraction displays, and perching distances of both males and females. Females exhibited an unusual decoying behavior during incubation and brooding, flushing from their nests as researchers approached (mean = 393 m, n = 304, range = 57 - 780 m, SD = 137 m). Median flushing distances differed significantly among individual females; $X' = 146.9$, $df = 46$, $p < 0.0005$. Barks, hoots, screams, attacks, and distraction displays differed significantly between the sexes. Males barked often, hooted little, and almost never screamed, while females barked and screamed frequently, but rarely hooted. Males exhibited more aggression than females, attacking during 237 nest visits (n = 2075) while females attacked only 52 times. However, females exhibited more distraction displays, performing on 204 visits (n = 2066), nearly 3 times as often as males. Perching distance differed significantly between the sexes with males perching an average of 40 m closer to researchers; $t = 6.1$, $df = 828$, $p < 0.005$.

FORAGING BY HAIRY, BLACK-BACKED, AND THREE-TOED WOODPECKERS IN POST-FIRE FORESTS OF THE NORTHERN ROCKY MOUNTAINS^{TWS}

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Woodpecker species occur in differing abundances across the landscape, but populations of several species typically are more dense in early post-fire forests than in green forests. We studied foraging behavior of 3 woodpecker species during year one of a five-year study on cavity-nesting birds in salvage-logged and unlogged post-fire forests in western Montana and eastern Idaho. Three of our four sites burned in 1994 and subsequently were partially salvage-logged; the fourth site burned in 1996 and was not logged. Here we summarize 202 observations of foraging hairy, three-toed, and black-backed woodpeckers from the 1997 breeding season. We observed single instances of foraging birds and recorded pertinent data including bird species, foraging, maneuver, foraging height, and tree species and dbh. We compared foraging variables among, species and to measures of available vegetation taken systematically across the sites. The three species used Douglas fir in 48%, ponderosa pine in 23%, and lodgepole pine in 20% of the foraging instances, with the remaining 9% of observations occurring, in subalpine fir, western larch, and Engelmann spruce. Black-backed woodpeckers used Douglas fir more often than either hairy or three-toed woodpeckers, while three-toed woodpeckers foraged on lodgepole pines to a greater extent than did the other two species. Also, average dbh of trees used for foraging was greater than average dbh of both nest trees and available trees. In subsequent years we expect to expand our analyses to detect differences in foraging between logged and unlogged treatments, and to examine woodpecker diets and prey densities.

STATUS AND DISTRIBUTION OF THE PYGMY RABBIT IN MONTANA^{TWS}

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Pygmy rabbits (*Brachylagus idahoensis*) were first documented in southwestern Montana in 1918. Historical distribution records are sparse at best, and concern over the status of the pygmy rabbit lead to a evaluation of its current distribution in Montana. The present distribution of the pygmy rabbit is defined and reflects historical distribution maps. Pygmy rabbits were present in all historical locations except one. Some evidence suggests a slight contraction in pygmy rabbit distribution. Habitat parameters are similar to occupied areas in other states. Big sagebrush (*Artemesia tridentata*) was slightly shorter in occupied sites in Montana and averaged 21.3 % coverage by line intercept method. In Montana, pygmy rabbits appear to prefer gently sloping or level floodplains where adequate sagebrush and soils exist. However, many different occupied sites have been located. Loss of preferred habitat through sagebrush removal is probably the greatest threat to the species. One calculated density in good habitat in Montana of 3.03 rabbits/ha is higher than reports from Washington and Oregon. Morphologically, pygmy rabbits are similar to those in other states with females weighing slightly more than males. Continued monitoring of the pygmy rabbit's distribution is recommended.

DISTRIBUTION AND DEMOGRAPHICS OF BIRD COMMUNITIES IN THE GREATER YELLOWSTONE AREAS^{TWS}

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During 1995-97, we estimated the composition and distribution of neotropical migratory bird communities on a 9,000 km² study area in the western portion of the Greater Yellowstone. The study area contains a wide diversity of habitat types and elevations. Our findings indicate that diversity and density of birds are much higher in aspen and cottonwood sites than they are in other habitats (e.g., Douglas fir, lodgepole pine, and others). However, our data also indicate that brood parasites such as brown-headed cowbirds (*Molothrus ater*) and egg predators such as black-billed magpies (*Pica pica*) are not evenly distributed among habitats. Rather, we found that cowbirds, magpies, jays, etc. were much more abundant in cottonwood stands than in aspen and other stand types. Therefore, we also measured reproductive success in hot spots for diversity and density, i.e., aspen and cottonwood stands, to determine if these habitats are beneficial to breeding birds. Preliminary data from both artificial (1994) and natural nests (1995) indicate that nest success is significantly lower ($P < 0.05$) in cottonwood stands than it is in aspen stands or in mature stands of lodgepole pine. Furthermore, preliminary population modeling indicates that cottonwood stands are population sinks for open-cup nesters that are susceptible to brood parasitism (e.g., warblers, sparrows, vireos, etc.): Management implications will be discussed.

ACUTE NUTRITIONAL STRESS IN WHITE-TAILED DEER DURING
THE 1996/97 WINTER IN NORTHWEST MONTANA^{TWS}

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Once every 200-300 years, maximum snow depth at Kalispell Airport reaches that recorded during the 1996/97 winter. Once every 33 years, an equal number of consecutive snow cover days would be recorded. Ungulate overwinter survival depends on many factors, including winter severity and possessing the necessary fat reserves to meet increased thermoregulatory demands and offset nutritional stress caused by low quality forage. To assess the timing and degree of acute nutritional stress in white-tailed deer (*Odocoileus virginianus*), the percent (%) marrow fat content was determined using the oven-drying technique for femurs collected from carcasses encountered during field work and along roadways from December 1996 to June 1997. We recorded sex and age, location, cause of death, and death date estimated to julian week. Cause of death was categorized as vehicle, predation, unknown, or natural (accidents and winter-kill). Percent marrow fat in adult females declined significantly through the winter for vehicle-kills ($p = 0.0001$) but did not decline for those adult females dying of natural causes ($p = 0.19$). In fawns, % marrow fat declined significantly through time for vehicle kills ($P = 0.008$) but not for natural deaths ($p = 0.66$). Fawn natural mortality commenced in late January whereas adult female natural mortality commenced in mid-February. Of those deer which died of natural causes, the marrow fat content averaged 72.4% (95% C.I. 65.7 - 79.1) for fawns and 66.9% (95% C.I. 58.1 - 75.8) for adult females. Mean % marrow fat for fawns dying of natural causes was significantly less than for predator-kills ($p = 0.02$), but the difference was insignificant for adult females ($p = 0.108$).

THE WINTER OF 1996/97: WHAT DID IT MEAN TO NORTHWEST MONTANA
WHITE-TAILED DEER POPULATIONS?^{TWS}

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The most notable attributes of the 1996/97 winter were its duration and the record snow depths at all elevations. The collective success of individual ungulates in surviving the winter has important implications for population dynamics and herd management. We assess the role that winter 1996/97 played in shaping population dynamics for white-tailed deer (*Odocoileus virginianus*) using data from an ongoing research project in the Salish Mountains. Fawns began dying of natural, winter-related causes in late January. The monthly observed fawn: 100 adult ratio declined

significantly from. December to March ($p = 0.02$). The predicted fawn: 100 adult ratio in May was 1: 100 (S.E. 7.4). The number of fawns per 100 adults estimated from remote camera surveys declined 44% in the same period, likely declining, further because deer remained on winter range for another 7 weeks post survey. Adult female natural mortality began in mid-February. Of the radio-collared adult females which survived the hunting season and entered the winter, 26% died by June 1, 1997. Fifty nine percent of the adult female mortality occurred in animals cementum-aged 6.5 or younger. Migrant radio-collared deer confined themselves to winter range an average of 159 days (range 126-185), or 8 weeks longer than the average of all previous years. Most deer entered winter range on November 23, 1996 and some stayed until May 27, 1997. Additional results and observations are discussed. Under the most ideal future conditions, it could take 3-5 years for populations in the Salish Mountains to rebound to levels prior to the severe winter event, even longer in areas which experienced harsher winter conditions.

HCP BASICS^{TWS}

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Habitat Conservation Plans (HCPs) are coming to the Rockies. HCPs are plans that support the issuance of Permits by the Fish and Wildlife Service and/or National Marine Fisheries Service (together referred to as the services) that allow incidental take of species listed under the Endangered Species Act. This presentation will describe the components of an HCP and permit, describe the application and development processes, and applicable criteria. Most importantly, this presentation will focus on biologists that work for tribes, state agencies, or other federal agencies giving them enough information about how HCPs are put together and when opportunities for public participation arise to make them effective participants in a negotiated process which is primarily conducted between the applicant and the services. The discussion will include specific examples from the HCPs being developed in the "coastal" Northwest and ample time will be allowed for questions and answers so as to tailor the session to the needs of the participants.

SURVIVAL RATES AND MORTALITY FACTORS OF ELK IN THE SOUTH FORK OF THE FLATHEAD RIVER, MONTANA^{TWS}

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We investigated survival rates and mortality factors of elk >1 year old on 2 project areas in the South Fork of the Flathead River, Montana from 1989 through 1997. On the Firefighter project area mean annual survival of cows ($n=84$) was

0.85±0.13. On the Spotted Bear project area (n=23) it was 0.84 ±0.16 and did not differ from that at Firefighter (p=.23). At Firefighter, survival of cows during the latter half of the study (6/15/93 - 6/15/97) was greater than during the first half (6/15/89 - 6/15/93) (mean annual survival=.89 and .82 respectively, p=.04). Possible reasons are discussed. Sample size precluded a similar test at Spotted Bear. Fifty-seven percent of deaths among cows (n=39) were somehow human-related. Causes of death were: 41% hunting, 28% winterkill/natural causes, 13%-wounding loss, 10% predation, 5% unknown, and 3% poaching. Survival among bulls from both project areas combined (n=20) was 0.69±0.22 and differed from that of cows on either project area (p<.02). Among, 17 bull deaths, 15 (88%) were by hunting, 1 (6%) by wounding loss, and 1(6%) by winterkill. The management implications of this level of human-caused deaths among both sexes of elk in habitat generally considered secure are discussed.

**MONITORING BREWER'S SPARROWS (*SPIZELLA BREWERI*)
USING SONG RECORDINGS^{TWS}**

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Formerly extensive sagebrush-shrub steppe areas of Washington have been substantially reduced and fragmented by conversion to agricultural uses. Thus, conservation of species found only in sagebrush habitats are a major concern for wildlife managers. As part of an ongoing study on the effects of shrub steppe fragmentation on nesting birds in eastern Washington, we color-banded individual male Brewer's sparrows, recorded their songs and tracked their nesting success throughout the breeding season. Recordings indicate that each individual male Brewer's sparrow possesses two different types of songs, termed simple and extended songs. Simple songs are individually distinctive and extremely variable among males within local populations. Thus, recordings of simple song act as acoustic fingerprints for identifying individual males. They are also produced repetitively from late April through the end of May. Recording simple songs during this period may provide a non-intrusive, cost-efficient method for monitoring adult survivorship of Brewer's sparrows and possibly other shrub steppe species.

EXOTIC PLANTS, WILDLIFE, AND ECOSYSTEM MANAGEMENT^{TWS}

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Public awareness of exotic, invasive plant problems is increasing and even though momentum has been increasing, there are still people who do not understand or are unaware of the impact on the environment. What is your understanding of the issue? Can you take newcomers through the issue step-by-step so they learn and grasp the significance? If not, please take the time to listen. Nearly every plant

referred to as a weed is not indigenous to this continent. Many have an unfair advantage in the environment because the biological controls on them were removed when the plant migrated here. No insects, fungus, or disease to keep them in check. There are over 2000 non-indigenous plant species in the United States but only about 200 that are invasive. However, there is new bio matter (seeds, stems or tubers) hitting our shores each year and many that are already here are evolving into the next potential spotted knapweed or leafy spurge. Presently weeds cover over 5% of the US, an area larger than the state of California. The Bureau of Land Management has estimated that weeds are increasing at a rate of 4,600 acres per day or 3 million acres per year. Weeds are spread by animals, people, equipment, wind, water, fire and hay. Activities that disturb the soil or plant community or reduce ground cover increase the likelihood of a weed-invasion. Some weed species are so invasive that they are taking over otherwise healthy ecosystems. Impacts of weeds on the environment include replacement of native vegetation, loss of wildlife habitat, loss of wildlife species diversity (60 - 80%) and monocultures on whole landscapes. Montana has over 8 million acres of spotted knapweed alone. Weeds like yellow starthistle will cause loss of recreational opportunities, livestock forage production is reduced (\$4.5 million in Montana). Areas infested with spotted knapweed are shown to experience 56 to 192% higher runoff and erosion. What can be done? Pass the word. Until people are concerned they are not going to be interested in solutions.

**NATIONAL BISON RANGE COMPLEX COMPREHENSIVE
CONSERVATION PLANNING^{TWS}**

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The National Bison Range Complex of the U. S. Fish and Wildlife Service (FWS) is comprised of the National Bison Range, Swan River National Wildlife Refuge (NWR), Ninepipe NWR, Pablo NWR, and the Northwest Montana Wetland Management District. The Complex is currently engaged in developing a comprehensive conservation plan for all units of the complex in addition to a decision document for acquisition for Lost Trail NWR. The who, what, where, when, and why of this public and internal planning process is presented. Ramifications of this process for individual stations and other National Wildlife Refuges in Montana are also discussed.

**AUTUMN AND SPRING RAPTOR MIGRATION
THROUGH GLACIER NATIONAL PARK^{TWS}**

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A raptor migration corridor used by bald eagles (*Haliaeetus leucocephalus*) travelling through Glacier National Park (GNP) was first documented in 1939. In October 1987, we also documented large numbers of golden eagles (*Aquila chrysaetos*) migrating through the park. Intermittent observations of migrating raptors using the Livingston and Lewis Mountain Ranges in GNP continued until, 1994, when more intensive observation began. Volunteer observers using binoculars and spotting scopes, recorded migrating raptors when weather conditions allowed visibility of a main migration route that crossed the McDonald Valley. Observations were standardized to record numbers of birds each minute from 1100 hr to 1800 hr. Raptors traveled between 1,830 m and 3,050 m above sea level using thermals and orographic lift. The entire park appears to be part of a migration corridor that is analogous to a large, braided river of birds flowing in main channels with connecting side channels. Between 1994 and 1996, golden eagles comprised over 80% of all raptors and 92% of all eagles documented in autumns at the McDonald observation point. Peak golden eagle migration in autumn was observed during early to mid-October and in spring, during the third week of March. In October 1996, 137 eagles were counted in a single hour. Total eagles counted in autumn during three years were: (1994) 2,242 in 91 hrs of observation; (1995) 1,991 in 109 hrs; (1996) 2,664 in 162 hrs. Spring totals were: (1995) 870 in 79 hrs and (1996) 904 in 86 hrs. Weather conditions appeared to influence numbers of eagles observed on a given day. Threats to migrating eagles in GNP include numerous unrestricted scenic overflights within travel corridors.

**STATUS OF SWIFT FOX (*VULPES VELOX*) SURVEYS
AND STUDIES IN NORTH CENTRAL MONTANA^{TWS}**

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Canadian wildlife agencies began a swift fox reintroduction program in southern Alberta and Saskatchewan, Canada in 1983. Over the next decade, these reintroduction efforts led to a strong possibility of individuals dispersing into north-

central Montana and creating a resident population. This study began in the fall of 1996 in northern Blaine County, Montana to confirm the presence of a resident swift fox population. The study involved systematic block live-trapping by township and radio collaring any swift foxes captured. In the spring of 1997, radio collared swift foxes were used to locate possible natal den sites and to confirm a resident population. A total of 16 swift foxes were trapped in the fall of 1996 and late summer of 1997. Five captures were juveniles and 11 were adults. Three litters were monitored in the summer of 1997. A study of home range, food habits, and survival is also incorporated into the study.