

## Fractured Landscapes

### **Fractured Landscapes Facilitate the Emergence of Novel Ecosystems**

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The Colorado Front Range is experiencing longer growing seasons, wetter winters, and changes in atmospheric chemistry that are altering the vegetation of our natural areas. These changes are being enhanced or facilitated by the fact that most natural areas consist of small parcels. Fragmentation has created corridors for some species and potential barriers to others. Fragments generate new microclimates that further alter the rules that structure the species composition of these communities. Since these changes are believed permanent and ongoing, conservation of the native biota requires some forward-looking, proactive management activities. We need to champion mechanisms that not only make it difficult for species we believe are harmful to succeed under these new conditions, but also use management activities that enhance the abundance of those species we wish to maintain within this changing environment.

### **Unraveling the Causes of Amphibian Population Declines in Colorado**

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Amphibian populations are at the forefront of the global biodiversity crisis, with more extinct or declining species than any other class of vertebrates. The causes of such declines are diverse and often interact through complex mechanisms, which may be difficult to disentangle from monitoring data alone. In wetlands along Colorado's Front Range, populations of the once-common northern leopard frog (*Lithobates pipiens*) have declined precipitously over the last 100 years. Observed declines have coincided with habitat loss, non-native species introductions, and emerging diseases. In cooperation with local, state and federal agencies, we are combining information from historical records, contemporary sampling of native and non-native amphibians, and epidemiological data to evaluate the current status of Colorado amphibians and the likely causes underlying their declines. Because amphibians depend on both aquatic and terrestrial habitats, they act as conservation sentinels for a broad range of native species in Colorado, underscoring the importance of identifying and addressing the ecological changes underlying their disappearance.

### **Ferruginous Hawk Diet and Behavior in Two Grasslands in New Mexico with Differing Anthropogenic Alteration**

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Ferruginous Hawk (*Buteo regalis*) populations are declining throughout their range. Likely causes of this decline include grassland habitat alteration and loss via energy development and human encroachment. I studied diet and behavior of Ferruginous Hawks on two grasslands in New Mexico that differed in anthropogenic alteration to learn more about this raptor's response to human-induced fragmentation during the nesting season. Hawks nesting in the anthropogenically-altered Estancia Valley consumed more Gunnison's prairie dogs (*Cynomys gunnisoni*) than Ferruginous Hawks in the rural Plains of San Agustin. Numerically, hawks in the Estancia Valley supplied nestlings with 87% more mass per delivery and 60% more mass per hour but 25% fewer prey items per hour than hawks in the Plains of San Agustin. This suggested that hawks in the Plains of San Agustin spent more time foraging but delivered smaller prey than hawks in the Estancia Valley. Because hawks in the Estancia Valley experienced greater reproductive success than hawks in the Plains of San Agustin, the availability of colonial mammals like prairie dogs, which offer low predatory search time, may have lessened the deleterious effects of moderate habitat alteration in the Estancia Valley. Intact prairie dog colonies should be conserved to enable maintenance of current Ferruginous Hawk productivity levels in the midst of increasing human development of natural areas.

### **The Effects of Climate Change on the Grasshoppers of the Rocky Mountains of Colorado**

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In this study we use the Alexander Grasshopper Collection coupled with a new resurvey program and climate data to measure the effects of climate change on grasshoppers found along an altitudinal gradient in the Rocky Mountains, near Boulder, Colorado. The Alexander Collection (<http://ghopclimate.colorado.edu/>) is composed of approximately 14,000 pinned grasshoppers and a series of field data notebooks from a three year 1958-1960 survey project. The 50 year climate data show that climate change in the Front Range is elevation dependent, with areas at mid-elevations experiencing the greatest warming. From our current three-year resurvey, we have found that grasshoppers at the warmest sites are emerging earlier and turning into adults nearly 15-28 days earlier than they did nearly a half century ago. We show that changes in growing degree days (a measure of energy available for organisms to develop) significantly predict the time at which grasshoppers are becoming adults.

### **Linkage Models in Integrative Conservation Planning**

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Animals move on a daily, seasonal and lifetime basis to meet their needs for forage, habitat and breeding. Human developments and activities often create barriers to wildlife movement, preventing these needs from being adequately met. Restrictions on these movements affect wildlife at all spatial scales, impacting individual animals as well as populations and even

species. Transportation infrastructure, in particular, is a principal cause of habitat fragmentation, with negative impacts on wildlife.

In Colorado, key wildlife species and their linkages were identified through the gathering of expert opinion from wildlife specialists in the region, then modeled to identify the spatial extent. The species included bighorn sheep, black bear, Canada lynx, elk, mule deer, pronghorn antelope, and swift fox. Modeling inputs included variables such as vegetation suitability, proximity to roads, elevation, and topography. More than 150 spatial models of species corridors were mapped throughout the state of Colorado.

### **Lions and Prions and Deer Demise--Chronic Wasting Disease in the Table Mesa area of South Boulder**

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Chronic wasting disease (CWD) is a fatal prion disease occurring in mule deer, white-tailed deer, elk and moose including mule deer inhabiting Open Space and Mountain Parks (OSMP) properties. Beginning in 2005, OSMP and the Colorado Division of Wildlife (CDOW) undertook a 3 year research project to examine CWD on OSMP and private property in the Table Mesa area to increase the understanding of CWD and CWD management. During the course of the study, we captured 131 mule deer and collared and monitored 115 adult deer. We tested each deer for CWD status once per year using live biopsy techniques. In addition, we performed a mark-resight census annually to estimate the population of mule deer residing in the study area.

We found CWD prevalence within the study to be quite high - overall approximately 29 percent of the deer sampled were infected. We also found that average survival time for infected deer was significantly lower than for uninfected deer. Cause of death varied somewhat between years, but the most common mortality causes were mountain lion predation, clinical CWD and vehicle collisions. Mark-resight inventory estimations of the deer population within the study area showed a decrease in local deer numbers over estimates derived from census efforts in the late 1980s. The high prevalence, low survivorship, and decreasing population numbers suggest that CWD is having a measurable effect on the mule deer herd living in south Boulder. High prevalence makes previously discussed management actions such as test-and-cull control unlikely to be feasible.

## **Riparian Renaissance at Coal Creek: Wildlife Response to Fencing and Buffering of a Prairie Stream Corridor**

Stephen Jones, Paula Hansley and Linda Andes-Georges, Boulder County Audubon Society and Boulder County Nature Association

In December 1999 Boulder Open Space and Mountain Parks, acting in partnership with the Terra Foundation and Boulder County Audubon, fenced 11 km of the Coal Creek riparian corridor to exclude cattle and minimize human disturbance. Old roads within the riparian corridor were restored to native vegetation, and old mining areas were regraded to create wetlands and restore the stream channel. An area management plan finalized in 2005 excluded recreational trails from the riparian corridor and much of the surrounding grasslands. Since completion of fencing, shrub growth has proliferated throughout the corridor, and summer populations of native shrub-nesting and cavity-nesting birds have more than doubled. Elk have returned to the riparian corridor for the first time since the nineteenth century, and a bald eagle pair has nested successfully. This restoration project illustrates how simple, short-term management actions can contribute to long-term rehabilitation of riparian and grassland habitats.