Change is Coming

Bats, Water, and Climate Change.
Rick A. Adams and Mark A. Hayes, University of Northern Colorado, Greeley, CO

Climate warming is occurring at an accelerated rate in Colorado, particularly at higher elevations affecting snow pack and subsequent water resource availability during the summer months. Bats provide an excellent bellwether for measuring climate-based loss of water resources because their reproductive physiology requires large water intake to balance evaporative transportation during roosting and to form milk for offspring. We measured water use of lactating females in natural populations by co-opting a novel PIT-tag reader system, originally designed to study fish, to instead record bats as they visited to drink at a waterhole. There were significance differences between the numbers of drinking passes for lactating versus nonreproductive females (N_{lac} = 236, N_{nonlac} = 15; Kruskal-Wallis, $p = 0.0001$). On average nonreproductive females visited the site 2.4 times nightly (SD = 1.4), whereas lactating females visited an average of 21.4 times nightly (SD = 8.6). From these data we construct a model for assessing the effects of climate-induced decline in water resource and what that means for the reproductive success of bat populations in Colorado, and ultimately to the loss of biodiversity from natural ecosystems in the West.

Brown-headed Cowbird Brood Parasitism at an urban/wildland interface of the Colorado Front Range.
Alexander Cruz, John W. Prather, Jameson F. Chace, Heather Swanson, Ty Tuff, Clint Francis, Lara Juliusson, John Walsh, and Andre Carvalhaes. Ecology and Evolutionary Biology, University of Colorado, Boulder, CO

Brown-headed Cowbirds *(Molothrus ater)* are generalist obligate brood parasites that use songbirds to incubate their eggs, brood their young, and provide parental care, and in so doing they often reduce the reproductive success of many of their hosts. From 1997 to 2004, we found and monitored over 950 songbird nests of 16 species that served as cowbird hosts in City and County of Boulder Open Space ponderosa pine and adjacent habitats. The Plumbeous Vireo was the main host with over 54% of nests (n = 125) parasitized, followed by the Warbling Vireo (38%, n = 32), Spotted Towhee (19%, n = 21), Western Tanager (15%, n = 74), and the Blue-gray Gnatcatcher (11%, n = 26). Parasitized Plumbeous Vireos fledged fewer young (0.5) than unparasitized vireos (2.1). The high incidence of parasitism and low fledlging success of vireos suggest that this may be a “sink” population and that immigration of individuals from a highly reproductive (“source”) population augment the vireo population. We found that cowbirds used the urban areas for foraging and roosting and traveled into ponderosa pine habitats in the

morning to parasitize songbird hosts. Cowbird abundance decreased with distance from the urban/wildland interface, and Plumbeous Vireo nests closer to the urban/wildland boundary were more likely to be parasitized than those farther away. Interestingly, cowbirds were found in lower numbers in small, isolated ponderosa pine patches, possibly related to the lack of vireos in patches smaller than 12 ha. Surprisingly some species that served as cowbird hosts elsewhere (e.g., the Western Wood-pewee) were rarely used as hosts (<1%, n = 259 nests). Differences in patterns of nest attentiveness and spatio-temporal patterns of foraging ecology may have accounted for the observed differences. Using the existing data set, with supplemental data we will collect in the upcoming field season, we plan to develop a model to calculate quantitative relationships for cowbird-host-interaction variables including: annual reproductive success, nest survival, parasitism rates, and cowbird demography. These variables can then be applied to a spatial analysis to better understand the impact of multiple land uses on those variables.

Climate Change: What's Really Going On – and What We Can Do About It?
Robert Henson, National Center for Atmospheric Research

Climate change is the top environmental issue of our time. Is global warming really something that will affect our lives and our children's? What does it mean for Colorado? Find out more in this overview that will include the latest findings from the Intergovernmental Panel on Climate Change as well as other recent studies. We will also learn more about what individuals can do to help protect our climate, from switching light bulbs to hitting the farmers' market.

Links to more information:

- NCAR outline of climate change topics, with links to more details
- Index to NCAR involvement in climate change studies
- Climate change FAQ

Inferring the Role of Climate Change in the Accelerating Decline of the American Pika.
Chris Ray, University of Colorado and Erik Beever, University of Minnesota-Duluth

The local extinction rate for American pikas in the western U. S. is quite high, and continues to rise. Existing populations are also 'moving uphill' at a rate that now far outpaces the elevational range-shifts reported for any other species. We estimate that the minimum elevation occupied by populations in the Great Basin has risen by more than 100 m within the past decade. Given the remote locations occupied by this species, there are a limited number of stressors hypothesized to affect such dramatic changes in its distribution. Climate change is one stressor that had been implicated in a previous analysis. We discuss new data on local extinctions, and new analyses being conducted to infer the role of climate change in these extinctions.