15TH BOULDER COUNTY ECOSYSTEM SYMPOSIUM (2008)

The Beetles are Coming

Historic Range of Variability of Wildfire and Insect Outbreaks in Front Range Forests

Thomas T. Veblen, University of Colorado Geography

Major forest policy concern in the U.S. West at the beginning of the 21st century focuses on the potential interactions between wildfire and forest insect outbreaks in the context of climate warming and land-use practices. A widespread viewpoint is that fire exclusion in the U.S. west during the past approximately 100 years has dramatically reduced the occurrence of formerly frequent low-severity fires which in turn has promoted an unnatural increase in forest density, exceptional susceptibility to outbreaks of insect pests, and higher risk of high-severity fires. This model of fire-exclusion, fuels buildup, and decline in forest health is a major driver of national and local forest policy. Similarly, the belief that widespread tree mortality caused by bark beetles and other insects dramatically increases potential fire danger is an untested assumption behind public concern and political responses to current bark beetle outbreaks in Colorado. In this talk I will examine the applicability of these premises to the forests of northern Colorado by considering the history of wildfire and insect outbreaks across the major forest types from ponderosa pine forests at low elevations to spruce-fir forests in the subalpine zone.

I will stress key findings of recent research on fire history and the interactions between insect outbreaks and fires in northern Colorado, including: 1) The widely accepted view that fire-exclusion during the 20th century has been the major driver of high tree densities has only limited applicability to Front Range forests (e.g. to approximately 20% of the ponderosa pine zone). 2) Current forest structures in both montane and subalpine forests strongly reflect the effects of widespread high-severity fires associated with severe drought in the second half of the 19th century. 3) The widespread fires of the 19th century in Colorado fit a continental-scale pattern of warmer and drier conditions associated with increased wildfires across western North America. 4) Following previous regional outbreaks of insect pests and widespread tree mortality in northern Colorado in the mid- and late-1900s, frequency and severity of wildfires did not increase. 5) Although the current mountain pine beetle outbreak in Coloradoappears to be unprecedented in extent and severity since good record keeping began in about 1920, large pre-20th century outbreaks of tree-killing insects are well documented in tree-ring records across northern Colorado. 6) Current bark beetle outbreaks from the U.S. southern Rocky Mountains (including Colorado) through British Columbia to Alaska coincide with climatic trends that are believed to be the major drivers of these outbreaks. Continued trends to warmer and drier conditions are likely to favor increased wildfire occurrence regardless of whether woody fuels are alive or killed by beetles. The likelihood that climatic trends will continue to increase fire

risk in forested areas already heavily used for residential purposes poses important challenges for forest management and land-use policies.

The Beetles are Coming

Jeffry B. Mitton, University of Colorado Ecology and Evolutionary Biology

This presentation has two parts. The first part explains the life history of mountain pine beetles and presents some aspects of the ecology of beetle epidemics. The second part is an illustrated discussion of the nature of this epidemic, and how it will proceed in Boulder County.

How does a little beetle kill an enormous tree? A mutualism with blue stain fungi and a mutualism with gut bacteria are needed to overcome the substantial defenses of pines. Pheromones are used to coordinate and focus an attack on a single tree.

Are we witnessing something different in this epidemic, which is distributed in the triangle defined by BoulderCounty, Vancouver and Edmonton? Forest biologists in Vancouver declare this epidemic to be the biggest ever. Forest biologists in Colorado glumly warn that all mature lodgepole in Colorado will be dead in five years. What are the various ecological and management variables that might explain the severity and extent of this epidemic? Fire history, stand management, and climate change are possible contributing factors.

Studying the Watershed Effects of Mountain Pine Beetles at the Fraser Experimental Forest

Chuck Rhoades, US Forest Service Rocky Mountain Research Station

Mountain pine bark beetle outbreaks are causing rapid, unprecedented change in the headwater forests of Western North America. In Colorado, bark beetle mortality now exceeds 1.5 million acres and the outbreak is projected to ravage 85 to 90% of the mature lodgepole ecosystems in Colorado and Wyoming within the next five years. Little is currently known about how catastrophic bark beetle outbreak will alter the physical and biological processes that regulate clean water delivery from Rocky Mountain watersheds. The consequences of this extensive canopy disturbance and subsequent management activities will characterize western watersheds and forest landscapes for decades to come.

Current RMRS research addresses the following questions:

1. Impacts of beetle-related tree mortality on the supply of clean water and the processes that regulate its delivery
2. Influence of salvage operations on nutrient, carbon, sediment and large wood retention within riparian buffers and validate the effectiveness of this watershed best management practice for protecting water quality and aquatic resources

3. How mechanical fuel reduction treatments and post-harvest site preparation impact seedling establishment and growth, plant nutrient and moisture relations, and biogeochemical and hydrologic processes
4. Impacts of forest road construction and retirement on hillslope hydrology and nutrient and sediment fluxes

These new studies link tree, hillslope and basin scale processes. They will generate information about snow accumulation, streamflow and water quality, forest water use and carbon storage, soil productivity, riparian and wetland species composition, and wood and stream channel dynamics in salvage logged and untreated areas infested by bark beetle.

Forest Service managers currently lack information to support sound land management decisions during the current bark beetle outbreaks. Our current research will help scientists and land managers to predict the consequences of the current beetle outbreak and to develop sound management responses. Specific beneficiaries of this work include: NFS hydrologists, soil scientists, fish biologists; municipal water planning staffs, the NFS Colorado Bark Beetle Cooperative and land managers across the West.

Front Range Forest Insects and Birds – Lessons Learned

Dave Leatherman

Anecdotal observations of Nature have value of their own, particularly when consolidated from multiple sources over long periods of time. They can also be used to frame needed research. Lessons learned from forest insects affecting the Front Range of Colorado, and our attempts to mitigate them, are many. Mountain Pine Beetle (MPB) outbreaks in ponderosa pine operate differently from those in lodgepole pine, and judging from the last three major epidemics in Colorado, nearly exclusively in one preferred host or the other.

Preventive spraying for MPB has proven to be generally effective and environmentally acceptable. Silvicultural prescriptions (widely referred to as thinning) to reduce the MPB susceptibility of ponderosa pine forests, while well developed and tested, have been poorly implemented.

Over centuries it appears ponderosa pine and Douglas-fir alternate dominance, at least locally, along the Colorado Front Range. Such forest phasing is influenced heavily by MPB and Western Spruce Budworm populations, respectively, with both being impacted by the imposition of governmental, long-term fire exclusion policies. Douglas-fir is perhaps the native forest species most influenced by fire exclusion, as evidenced by its increased presence on many so-called pine sites. Also offered as evidence is the unprecedented change in behavior of the Douglas-fir Tussock Moth, formerly confined to ornamental Colorado Blue Spruce but now increasingly common as a defoliator of off-site, wildland Douglas-fir forests.

In Colorado, exotic insects from Asia are either imminent (the Emerald Ash Borer, a buprestid wood boring beetle, introduced into Detroit and now spread as far westward as Illinois) or

already here (Banded Elm Bark Beetle). Both insects are thought to have entered North America in wooden packing material.

The organismic evidence of climate warming is extensive. Among conspicuous examples are: the present occurrence of Mountain Pine Beetle approximately 1500 feet higher on mountainsides than was common just 3 decades ago; multiple individuals apparently representing established populations of two southern butterfly species discovered for the first time in Colorado last summer (Hayhurst's Scallopwing and Bordered Patch); an established colony of the tropical dragonfly Roseate Skimmer discovered last summer in a Fort Collins natural area; the first Coloradooccurrence of a Brown-crested Flycatcher on the Pawnee Grasslands; the recent impact of Walnut Twig Beetle, a species previously only known from the southwestern U.S., on urban walnuts along the Front Range and Boulder in particular; the dramatic northward range expansions of late by southern birds such as Black Phoebe, White-winged Dove, Eurasian Collared-Dove, and Inca Dove; and the recent occurrence of a Nine-banded Armadillo in Lamar.

Boulder County Forest Restoration and Fire: Challenges of Current Science, Entrenched Beliefs, Public Perceptions and Internal Processes

Chad Julian, Boulder County Parks and Open Space

Managing forests and the associated disturbances can at times be challenging. Land managers have to balance public perceptions, political realities, economic realities, internal planning processes and current scientific knowledge. The question is how do we balance these interests that at times can be in conflict. I will show the processes that we as land managers look at to bring all of the interests together to develop management strategies to accomplish successful on the ground management.

Forest Thinning and Breeding Bird Communities

Heather Swanson, Boulder Open Space and Mountain Parks

The ponderosa pine forests of the Colorado Front Range, like many across the west, have been subjected to strict fire suppression since European settlement. This has resulted in an altered forest structure with increased susceptibility to catastrophic fire and insect epidemics. Forestry practices including thinning and prescribed burning are often used by management agencies to mitigate these threats and return the forest to a healthier structure and condition. However, little research has examined whether the structural changes associated with this management improve wildlife habitat characteristics. Locally, both the City of Boulder Open Space and Mountain Parks Department and Boulder County Parks and Open Space have used thinning on open space lands to meet their forest management goals. In studies of breeding bird communities both before and after management, we have determined that forest structure changes influence the bird community found. This suggests that these forestry methods offer a good opportunity to improve

habitat for a variety of bird species and highlights the need to consider bird community management goals in future forest management planning.

High Elevation Birds and Recent Climate Change: Are These the Good Years?

Dave Hallock, Boulder County Nature Association

The Indian Peaks Four Season Bird Counts have been held in western Boulder County since 1982. The all-volunteer event conducted by a core of dedicated individuals, epitomizes citizen science at its base, and is sponsored by theBoulder County Nature Association. Total birds detected during the breeding season have shown an increasing trend over the count's twenty-seven years. Climate data from the Mountain Research Station for the count period show an increase in temperature and decrease in precipitation. Peaks of total birds detected appear associated with warm and dry periods, while cool and wet events may trigger declines. Given the somewhat casual nature of the counts, which generally follow a Christmas bird count format, we certainly wonder if the relationships between increased detection, increasing temperature, and decreasing precipitation are purely by chance. Information from other avian studies suggests that these relationships might be occurring. Two other changes in the high elevation avian community to be discussed are the recent and increasing regular sightings of Brewer's sparrows during the breeding season in the krummholz, and the earlier arrival of migrants in the spring.