

# Restoring the West Conference 2006: Aspen Restoration

September 12-13, 2006  
Utah State University  
Logan, Utah

EXTENSION

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General Conference Co-chair

USDA Forest Service, Rocky Mountain Research Station

### **Mike Kuhns**

General Conference Co-chair

USU Forestry Extension and Department of Wildland Resources

### **Ron Ryel**

General Conference Co-chair

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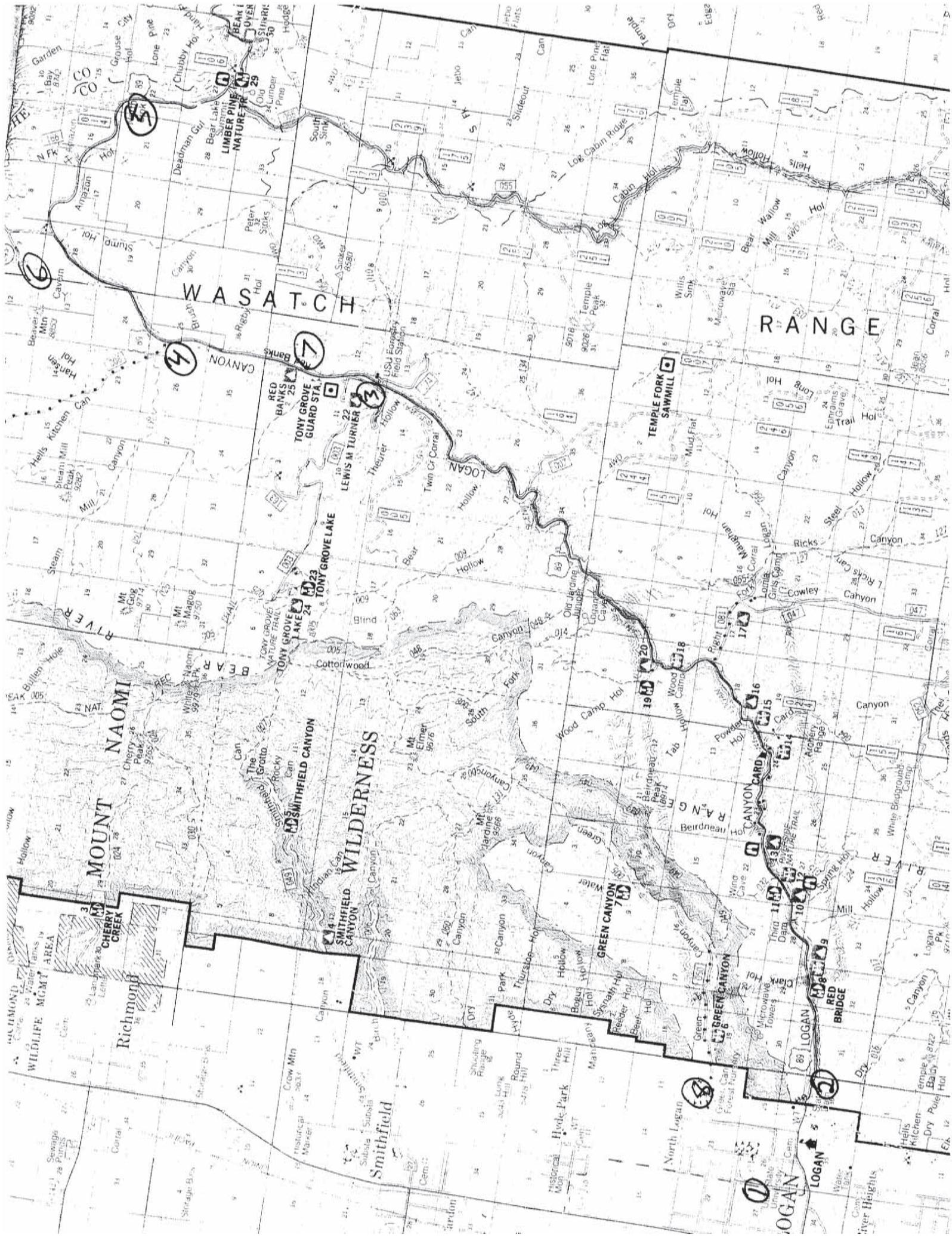
**USDA Forest Service State and Private Forestry**

# Agenda

<b>Tuesday, September 12, 2006:</b> All general session presentations at USU Eccles Conference Center Auditorium (no concurrent sessions)	
8:00-9:00 am	Registration, continental breakfast
9:00-9:15 am	Welcome, introduction, overview. <i>Dr. Mike Kuhns, Professor, &amp; Dr. Ron Ryel, Assistant Professor, USU Wildland Resources Department; Dr. Dale Bartos, Project Leader, USDA Forest Service Rocky Mountain Research Station</i>
9:15-10:00 am	Massive aspen dieoff in the western U.S.: What is going on? <i>Dr. Wayne D. Shepperd, Research Silviculturist, USDA-FS Rocky Mountain Research Station, and John Guyon, Pathologist, USDA-FS State and Private Forestry</i>
10:00-10:30 am	The impact of native ungulates and livestock on western aspen communities. <i>Dr. Charles Kay, Adjunct Associate Professor, USU Political Science Department</i>
10:30-11:00 am	Break
11:00-11:30 am	Water relations and water yield in aspen and conifer forests. <i>Dr. Ron Ryel, Assistant Professor, USU Wildland Resources Department</i>
11:30 am-noon	Wildlife issues related to aspen decline and restoration. <i>Andreas Leidolf, Assistant Professor, Westminster College (Missouri)</i>
Noon-1:30 pm	Lunch (provided)
1:30-2:00 pm	Aspen restoration efforts on the Fishlake National Forest: Lessons learned. <i>Robert B. Campbell, Ecologist, Fishlake National Forest, Allen Henningson, &amp; Dale Bartos, Project Leader, USDA-FS Rocky Mountain Research Station</i>
2:00-2:30 pm	Habitone analysis of quaking aspen in the Book Cliffs of Utah: Effects of site water demand and conifers on aspen cover. <i>Joseph O. Sexton, Nicholas School of the Environment and Earth Sciences, Duke University</i>
2:30-3:00 pm	Using genetic tools in western aspen ecology, conservation, and management. <i>Dr. Karen Mock, Assistant Professor, USU Wildland Resources Department</i>
3:00-3:30 pm	Break
3:30-4:00 pm	The Nevada and Eastern Idaho Aspen Working Groups: Organization and efforts. <i>Genny E. Wilson, Wildlife Biologist, Humboldt-Toiyabe National Forest and Steve Schmidt, Regional Supervisor, Idaho Fish and Game</i>
4:00-4:30 pm	Discussion, wrap-up. Facilitated by <i>Dr. Dale Bartos, Project Leader, USDA-FS Rocky Mountain Research Station</i>
5:30-7:30 pm	Poster session and reception, cash bar: Cafe Sabor, 600 West Center

## Agenda, continued

<b>Wednesday, September 13, 2006:</b> Logan Canyon aspen restoration field trip. Transportation, lunch, and snacks provided.	
8:15 am	Busses arrive at University Inn.
8:30 am	Busses leave University Inn, go to First Dam.
8:45 am	Busses leave First Dam, proceed up Logan Canyon.
9:15 am	Arrive and unload at Tony Grove second switchback. Presenters: Wayne Shepperd and Dale Bartos on aspen die-off and decline; Rob Cruz on aspen situation on the Logan Ranger District.
10:00 am	Busses load and head up-canyon towards Franklin Basin.
10:15 am	Busses arrive and unload at Franklin Basin parking lot. Presenters: Jim Long and Antonin Kusbach on ecological monitoring.
10:45 am	Load busses, proceed up Logan Canyon.
11:00 am	Arrive and unload at Swan Flats. Presenters: Ron Ryel on aspen genetic diversity, Bob Campbell on selecting materials for the common garden, and John Guyon on aspen pathology.
11:45 am	Load busses, go down-canyon to Beaver Mountain.
Noon	Box lunches at Beaver Mountain. Presenters: Ron Ryel and Rick Danvir on aspen research at Deseret Land and Livestock.
1:30 pm	Load busses, continue down Logan Canyon.
2:15 pm	Arrive at Red Banks. Presenters: Mike Jenkins and Logan Ranger District Representative on prescribed burning efforts in aspen in Logan Canyon.
2:30 pm	Load busses, continue down Logan Canyon.
3:00 pm	Arrive and unload at Green Canyon Common Garden. Presenters: Bob Campbell on establishment and early history of common gardens, and Ron Ryel on recent work at the gardens.
3:45 pm	Load busses, return to First Dam and University Inn.



WASATCH

RANGE

MOUNT NAOMI

WILDERNESS

CHERRY CREEK

Richmond

Smithfield

GREEN CANYON

LOGAN RIVER

RED BRIDGE

TONY GROVE LAKE

TONY GROVE LAKE

TEMPLE FORK SAWMILL

LOGAN RIVER

LOGAN RIVER

SMITHFIELD CANYON

TONY GROVE LAKE

LOGAN RIVER

# Speaker Abstracts

Presenting author in italics

## **Massive Aspen Die-off in the Western U.S.: What is Going On?**

*Wayne D. Shepperd*, USDA-FS Rocky Mountain Research Station, Fort Collins, CO, and John Guyon, USDA-FS State and Private Forestry, Ogden, UT.

Aspen die-off differs from normal aspen vegetative succession or decline in that mature trees die quickly within a year or two and no new sprouting occurs as a result. Lack of sprouting may indicate that lateral roots are also dead, preventing aspen from re-occupying the site. Die-off seems to begin in epicenters and spread radially through an affected aspen stand. Stands on all topographic positions, moisture regimes, and soil types are affected and the phenomenon has been reported throughout the west from Arizona into Alberta. Die-off can affect one clone and leave other nearby clones untouched. Younger age classes and advanced regeneration are often not affected to the same extent as mature overstory trees in the same clone. Cytospora cankers, poplar borers, and other damage or stress agents are often associated with die-off epicenters.

Our presentation will discuss factors that may be associated with aspen die-off and present potential hypotheses to be investigated in multidisciplinary research to identify casual agents or environmental factors contributing to aspen die-off and determine whether possible management options exist to reduce the risk of die-off, or loss of parent roots.

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## **The Impact of Native Ungulates and Livestock on Western Aspen Communities**

*Charles Kay*, Utah State University, Logan, UT

Repeated browsing by mule deer, elk, cattle, or domestic sheep often prevents aspen from successfully regenerating on intermountain ranges - - defined as producing new stems greater than 2 m in height. Bark damage by elk can also hasten the decline of existing aspen trees (ramets). Excessive browsing may even eliminate entire aspen clones. In addition, ungulate use has a dramatic impact on understory species composition. Deer, elk and domestic sheep tend to remove palatable shrubs and forbs, while cattle tend to eliminate native grasses. Aspen stands heavily used by both wildlife and livestock are usually dominated by unpalatable forbs and non-native grasses, such as timothy or Kentucky bluegrass. If ungulate herbivory is excessive, fire will not successfully regenerate aspen. Instead, fire plus excessive herbivory only hastens the decline of aspen. Similarly, beaver-felled aspen will not successfully regenerate if the emerging suckers are repeatedly browsed by wildlife or livestock.

This raises the question of how aspen successfully regenerated in the past. Late 1800 photographs indicate that, historically, aspen was unbrowsed. First-person journals and archaeological data indicate that prior to European settlement, hunting by native people kept ungulate populations at very low levels. Thus, the heavily browsed aspen communities seen on many western ranges today are entirely outside the range of historical variability.

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## **Water Relations and Water Yield in Aspen and Conifer Forests**

**Ron Ryel** and Eric LaMalfa, Department of Wildland Resources, Utah State University, Logan, UT 84322-5230

Aspen decline in the Intermountain West is associated with changes in resources values. Reduction in water yield with the conversion of aspen to conifer has been one hypothesized change that has important implications for water resources in these semi-arid lands. Hypothesized mechanisms include differential accumulation of snow, melting patterns, and plant water use rates. We evaluated these mechanisms to assess the potential for differences in water yield with conversion of aspen stands to conifer. Our results indicate significant differences in water accumulation in the peak snow pack as the most likely mechanism to result in changes in water yield. These differences could have profound effects on both watershed water yield and on ecosystem function. Potential ecological consequences of restoring aspen to increase watershed water yield are discussed.

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## **Wildlife Response to Aspen Decline and Restoration: Current Status and Future Directions**

**Andreas Leidolf**, Westminster College, Fulton, MO, and Ron Ryel, Utah State University, Logan, UT.

The loss of montane aspen forest to invasion by conifers is a prime example of the many vegetation changes that have occurred in the Intermountain West over the past century. Certainly, wildlife habitat and species diversity have been negatively affected by these changes, but evidence indicates that water yield may have also been significantly reduced. Recent prolonged periods of drought in the Intermountain West have thus led to renewed interest in vegetation manipulation and restoration for the purpose of increasing water yield, decreasing fire potential, and improving habitat quality of forests and rangelands, including aspen. Yet, the response of wildlife, such as birds and small mammals, to aspen restoration is largely unknown.

Here, we review the state of our knowledge regarding the response of wildlife to aspen decline and restoration. Because of the relative paucity of studies from montane aspen, we make frequent reference to work conducted in boreal aspen communities. In addition to providing a comprehensive review, we also identify gaps in our knowledge, suggest research questions most in need of attention, and highlight areas of research that hold the greatest promise for the elucidation of general response patterns. In doing so, we focus primarily on the study of avian communities for several reasons: birds are extremely sensitive to spatio-temporal changes in the environment; are generally viewed as important indicators of ecosystem integrity; provide a simultaneous assessment of a wide range of ecosystem attributes; and are easily and inexpensively monitored using well-established and easily replicated protocols. We also discuss the implications and limitations of using birds as a model organism for assessing wildlife response to aspen restoration.

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## **Aspen Restoration Efforts on the Fishlake National Forest: Lessons Learned**

Henningson, Allen V., USDA-FS Fishlake NF, Richfield, UT, **Robert B. Campbell, Jr.**, USDA-FS Fishlake NF, Richfield, UT, and Dale L. Bartos, USDA-FS Rocky Mountain Research Station, Forestry Sciences Lab, Logan, UT.

More than 30 different areas with aspen, totaling at least 20,000 acres, have been treated on lands administered by the Fishlake National Forest during the past 25 years. Aspen harvests, conifer harvests, prescribed burns, combinations of these treatments, wildland fire use, and wildfire have all resulted in vigorous stands of young aspen. Examples of these treatments will be shown and discussed. Some of these areas had stable aspen stands; other areas had decadent aspen where the stands were falling apart. However, most of the treated areas were successional to conifers and included a component of Engelmann spruce, sub-alpine fir and/or Douglas-fir.

Many of these areas show excellent, or acceptable, success for aspen regeneration. However, responses have been mixed; not all have done well, and others essentially do not have any aspen regeneration remaining in the treated area. Several lessons can be learned from these treatments on the Fishlake N.F. Aspen will respond to a variety of treatments done during every season of the year. It is rare that a stand with aspen present would not produce suckers, usually abundant, if the hormonal response is stimulated. Protection may be necessary for young aspen suckers to establish and thrive. Many areas have been fenced; some have high fences to exclude wildlife while other fences exclude only livestock. However, the fences may have been installed too late in a few cases. There is value in using three-way exclosures to help determine the kind of use. Treatments can be modified to enhance environmental conditions for optimum sucker production. We recommend that only a part of the clone or area be treated at one time; do nothing in the remaining portion. Use fire as an element of the treatment if advanced conifer regeneration is abundant and likely to compromise successful aspen regeneration. Priority should be given to treating areas that are successional to conifers.

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## **Habitone Analysis of Quaking Aspen in the Book Cliffs (Utah, USA): Effects of Site Water Demand and Conifers on Aspen Cover.**

**Joseph O. Sexton**, Nicholas School of the Environment and Earth Sciences, Duke University, Durham, NC; R. Douglas Ramsey, Department of Forest, Range, and Wildlife Sciences, Utah State University, Logan, UT; Dale L. Bartos, Rocky Mountain Research Station, USDA Forest Service, Logan, UT

Quaking aspen (*Populus tremuloides* Michx.) is the most widely distributed tree species in North America, but its presence is declining across much of the western United States. Aspen decline is complex, but results largely from two factors: 1) regional Holocene climatic drying has led to water limitation of aspen seedling recruitment, and 2) anthropogenic fire suppression during the 20<sup>th</sup> century has allowed shading of aspen clones by fire-intolerant conifers. These processes interact variously and often diffusely, but traditional, binary habitat mapping approaches can only resolve their net effect after complete loss of aspen patches. To inform land management in the Book Cliffs—a biogeographic link between the Utah and Colorado Rocky Mountains and a location experiencing typical aspen decline—we developed a regression-based generalization of habitat analysis that is both usable in GIS and capable of detecting anomalies in cover before complete patch conversion. We estimated the realized niche of quaking aspen to potential evapotranspiration (*PET*) with regression trees, projected aspen's niche expectation and uncertainty geographically, and correlated differences between observed and expected aspen cover to remotely sensed conifer cover. Results confirm the strong constraint of

site water demand on aspen cover and suggest that conifer cover decreases aspen cover beneath its expectation given the *PET* environment. Compared to sites without quaking aspen, our aspen sites had lower *PET* in every month of the growing season, but the difference increases over the growing season as drought effects become more extreme. Conifer cover displaces aspen cover and shows a positive correlation with niche-model deviance ( $r = 0.344$ ). Ultimately, the thematic information conserved by our approach allowed us to resolve detailed rasters of management potential and map a modest potential increase of aspen cover—14.63 ha (0.14%) of the study area, or +2.46% of current aspen cover—within one management cycle.

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## **Using Genetic Tools in Western Aspen Ecology, Conservation, and Management**

**Karen Mock**, Utah State University, Logan, UT, and Carol Rowe, Utah State University, Logan, UT

In recent years, a broad range of new genetic tools have become available for use in aspen and other *Populus* species. These tools are allowing us to answer important questions about clonal dynamics, mutation accumulation, the frequency and geography of sexual reproduction, and assessment of genetic diversity in aspen stands. Our laboratory is involved in rangewide and regional phylogeographic studies in aspen (*Populus tremuloides*) as well as two smaller-scale studies of local genetic variation. The scope and status of these projects will be discussed, along with preliminary results.

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## **Nevada Aspen Working Group: Focusing on Aspen**

**Genny Wilson**, USFS: Humboldt-Toiyabe NF, Sparks, Nevada

Recognizing that knowledge of aspen is limited in Nevada, the Nevada Aspen Working group was formed in Summer 2005. This small working group is comprised of individuals from State and Federal agencies in addition to non-governmental organizations with an interest in the restoration and persistence of aspen across Nevada. The primary goals of the group are to determine the overall distribution, condition, and stressors on aspen in Nevada. Our mission is to provide land managers, private landowners and others the tools to recognize declining aspen conditions, identify issues related to aspen management and apply appropriate methods to aspen restoration. Over the past year, the group has focused on establishing a common data depository; education; gaining a common understanding of the issues affecting aspen in Nevada; and identifying additional partners who have funding and the ability to do work on the ground. The Nevada Aspen Working Group is assisting the Society of Range Management in sponsoring a half-day technical session in Reno-Sparks, Nevada in February 2007.

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# Poster Abstracts

Presenting author in italics

## **The Aspen Delineation Project**

*David Burton*, Aspen Delineation Project, Penryn, CA

The Aspen Delineation Project is a collaborative effort of the U.S. Forest Service's Pacific Southwest Region, the California Office of Bureau of Land Management, and the California Department of Fish and Game. The Aspen Delineations Project overarching objective is to help agencies identify, map, treat, and monitor aspen (*P. tremuloides*) habitats. It has also been asked to explore challenges, issues, and roadblocks surrounding aspen management on public lands.

Since its inception in 2002, the Aspen Delineation Project has sponsored many events and activities designed to provide agency personnel with information and tools that will enhance their ability to manage aspen. It has (1) cosponsored symposia with the University of California at Davis, the Western Section of the Wildlife Society, and the Nevada Chapter of the Society of Range Management; (2) coordinated the development and implementation of standardized aspen inventory and stand assessment protocols among cooperating land and resource management agencies in California, Nevada, Idaho, and Washington; (3) worked with the Forest Service on the development of utilization and effectiveness monitoring protocols for monitoring aspen regeneration on rangelands; (4) established a website ([www.aspensite.org](http://www.aspensite.org)) containing databases dedicated to the research and management of aspen habitats; (5) conducted multiple aspen field seminars in California, Nevada, and Idaho, (6) facilitated an aspen restoration funding initiative for BLM rangelands in California.

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## **Aspen Restoration on the Eagle Lake Ranger District, Lassen National Forest, California**

*Bobette E. Jones*, Tom H. Rickman, and Alfred Vazquez, United States Forest Service, Susanville, California.

There is concern about the decline of aspen (*Populus tremuloides* Michx.) and the lack of successful regeneration in existing stands throughout the west (Mueggler 1985, Bartos and Campbell 1998, and White et al. 1998). Unfortunately, as in many western landscapes, California's aspen communities are steadily being replaced by conifers due to changes in historic fire regimes and grazing pressure (Di Orio et al. 2005). Observations on Eagle Lake Ranger District (ELRD), Lassen National Forest (LNF) indicate that a significant reduction in the distribution and health of aspen has occurred since European settlement. Due to these concerns, ELRD initiated an active restoration program to improve aspen stand health and ecological integrity (Jones et al. 2005).

First an aspen inventory and risk assessment project was conducted from 2000-2005 to produce a complete inventory of aspen on ELRD. Stand condition, based on Bartos and Campbell's (1998) risk assessment, and specific management recommendations, based on Shepperd's (2001) aspen restoration triangle, were collected to include in NEPA documents to allow the required restoration activities to take place. A total of 691 stands covering 3,681 acres (mean stand size of 5.4 acres and median stand size of 1.28 acres) were inventoried. Eighty percent of the stands received a Highest or High priority rating, indicating that the majority of aspen stands are at risk of being lost from the landscape. Conifer removal and/or fencing were recommended for 95% and 57% of the stands respectively.

Second, restoration treatments were implemented: conifer removal (commercial harvest and hand thinning) in 84 stands and fencing (livestock or wildlife) in 54 stands. Effectiveness monitoring for adaptive management was employed by the Forest Service and various partners in a collaborative effort to evaluate the response of aspen and associated species within the community to each treatment. We present results from our inventory to indicate the urgent need for restoration to prevent future loss, and present data from our effectiveness monitoring to show the success of restoration treatments.

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## **Protecting Aspen Regeneration from Ungulate Utilization in the Black Hills**

Andrew M. Kota, Utah State University, Logan, UT, and **Dale L. Bartos**, Rocky Mountain Research Station, Logan, UT

Excessive browsing by cattle (*Bos taurus* L.) and wild ungulates, particularly elk (*Cervus elaphus* L.), inhibits growth and maturity of regenerating quaking aspen (*Populus tremuloides* Michx.) suckers. In areas where aspen stands are in poor condition or declining, protecting suckers from ungulates may be necessary. Lack of funding or inaccessibility of machinery can prevent managers from constructing fences where they are needed. This study compared the utility of livestock fences, complete wildlife exclosures, barriers created from slash debris, and by a new technique referred to as tree “hinging”. This study was done during 2004 and 2005 in the southern portion of the Black Hills, South Dakota.

All of the barriers significantly reduced ungulate utilization percentages on aspen suckers compared to the pretreatment average (78%), and posttreatment control (79%). Slash treatments and livestock fences decreased ungulate utilization by 19%, hinge treatments decreased utilization by 39%, and wildlife fences eliminated nearly all browsing. The average terminal length removed per aspen stem decreased from 20.8 cm to 14.4 cm over the course of the study. After 1 year, the mean of suckers above 100 cm in height in both the hinge and slash treatments were significantly greater than both the fence treatments and control. Browsing was heaviest throughout autumn and winter. Where fecal deposits were tallied, it suggested elk as the primary browsers.

Slash barriers can replace livestock fences where cattle are the main user of aspen suckers. Hinge barriers are more useful than both slash barriers and livestock fences in areas where wild ungulates are the primary aspen sucker browsers. Protection by hinging was not as complete as wildlife exclosures, but more area could be treated at less cost using this method. Treatments created from on-site forest materials should only be implemented postregeneration because they shade the ground and can diminish suckering.

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## **Differences in Water Transfer Mechanisms between Aspen and Conifer Communities: The Fate of Spring Snow Melt in a Northern Rocky Mountain Watershed**

**Eric M. LaMalfa** and Ron Ryel, Department of Wildland Resources, Utah State University, Logan, UT.

Altered disturbance regimes have led to rapid displacement of aspen communities by conifer forests throughout the west. It has been hypothesized that the increase in conifer dominated forests has led to decreased

net annual water yield. Water yield augmentation experiments have allowed for speculation on the effects of cover type conversion, with the general agreement that deciduous forests yield more water than coniferous forests. However, differences in water yield resulting from cover type conversion have not been tested and there still remains a gap in our knowledge of the biological and physical mechanisms that might lead to net water yield differences between forested community types. An investigation into the relative importance of individual water transfer mechanisms was undertaken to examine differences in forest water balance occurring under annual time scales in a Northern Rocky Mountain watershed. The water transfer mechanisms investigated included: surface snow accumulation, ablation, evaporation/sublimation, soil moisture recharge, and transpiration (sap flux). Measurements were taken throughout the fall, winter, and spring snowmelt. The mechanisms leading to significant water yield differences included snow accumulation and soil moisture recharge as affected by differences in the seasonal transpiration patterns. The peak Snow Water Equivalent (SWE) measured beneath conifers was consistently diminished relative to the SWE in the aspen stand. The period of annual transpiration activity was longer in conifers which lead to diminished fall soil water recharge during precipitation events. Future quantification of water yield differences between aspen and conifer communities should focus on snow accumulation, soil moisture recharge, and transpiration.

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## **Climate Affects Ungulate Browsing and Aspen Recruitment, with ‘Trickle-Down’ Effects on Birds**

Thomas E. Martin and *Karie Decker*, USGS Montana Cooperative Wildlife Research Unit-University of Montana, Missoula, MT

A 21-year study of a high elevation riparian system in north-central Arizona has documented long-term declines in aspen and other deciduous trees. This decline reflects a complex interaction between elk browsing and climate. Historically this area has received large amounts of winter snow, nurturing sapling growth and pushing elk out of the area to browse at lower elevations. Winter snowfall has declined over the last 21 years, typical of the West, leading to an increase in over-winter browsing, and limiting water availability for deciduous plants. These plants serve as the preferred breeding habitat for many bird species, several of which show declining populations and one that has become locally extirpated. In an attempt to understand how climate change and herbivory affect deciduous plants and thereby bird populations, three replicate drainages of 9 ha were fenced during the fall of 2004 to exclude elk and deer. After only two years, significant changes occurred in the recruitment of aspen and other deciduous trees, as well as increases in bird abundance.

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