Restoring Burned Area Fire Regimes at Zion National Park

Kelly Fuhrmann, Zion National Park, State Route 9, Springdale, UT 84767; kelly_ fuhrmann@nps.gov

Introduction

The Kolob Fire is the largest wildfire in Zion National Park's recorded history (10,516 acres in Zion and 17,632 acres total; Figure 1). In June 2006, this human-caused fire altered the landscape in Zion on a scale that was unprecedented (Figure 2). A major concern of the fire's impact was the loss of native vegetation and its replacement by non-native invasive species. After the burned area emergency rehabilitation (BAER) assessment was completed, a focused effort by park staff was initiated to implement recommended BAER actions. In late October and early November 2006, an aerial herbicide and seed treatment using PLATEAU herbicide and native grass and forb species seed was applied by helicopter to the Kolob Fire area in Zion. The goal of these treatments is to encourage native perennial plant re-establishment and diversity in areas that are being threatened by cheatgrass invasion.

Methods

To combat the competitive strategies of cheatgrass, we chose a restoration approach that included the use of aerially sprayed PLATEAU herbicide over the entire extent of the 10,516 acres of the Kolob Fire (Figure 3). This product has been thoroughly tested and approved for use by the U.S. Environmental Protection Agency. PLATEAU is a highly selective herbicide that targets many of Zion's invasive, non-native species, including cheatgrass, ripgut brome, annual mustards, puncture vine, and field bindweed. Imazapic is the active ingredient in PLATEAU herbicide. It works by affecting proteins specific to plants which are not present in animals, and therefore they are not affected. Imazapic is essentially non-toxic to a wide range of non-target organisms including mammals, birds, fish, aquatic invertebrates, and insects. It does not bio-accumulate and has limited mobility in soil. After an application of Imazapic, there is little potential for

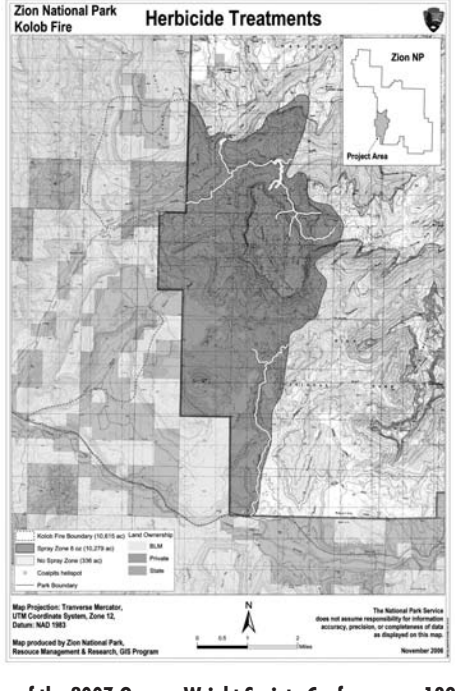

Figure 1. The human-caused Kolob Fire ignited along the Kolob Terrace Road in Zion National Park. Extreme fire behavior throughout the burn resulted in an intense, fast-moving fire that burned over 17,000 acres of NPS, BLM, and private lands in less than four days. The fire intensity and resulting fire severity influenced recommended restoration techniques by the BAER team to accommodate post-fire rehabilitation successes.

Figure 2. Terrain within Zion National Park and adjacent lands combined with strong wind and very dry conditions provided challenges to firefighting efforts during the Kolob Fire. It also facilitated extreme fire behavior over much of the fire and created challenges to suppression activities in canyons of Color Country. The majority of burned acres are part of an old-growth pinyon–juniper forest in Zion National Park. NPS photo.

Figure 3. The USGS and NPS began collaborating in 2004 on a project focused on the control of exotic/invasive cheatgrass *(Bromus techtorum)* using a combination of treatments in Zion Canyon. These treatments include a combination of mowing, burning, and herbicide application using PLATEAU herbicide. This information was used to plan restoration efforts on the large-scale restoration project after the Kolob Fire. NPS photo by C. Decker.

movement off of the treated area. It is also moderately persistent in soil which allows for full-season control of targeted species (Vollmer and Vollmer 2006).

In addition to the herbicide application, we used a mix of native grasses and forbs over 500 acres of the fire that, previous to the fire, were heavily infested with cheatgrass. This mix consisted of bottlebrush squirreltail (*Elymus elymoides*), sand dropseed (*Sporobolus cryptan-*

drus), scarlet globemallow (*Sphaeralcea coccinea*), and Palmer penstemon (*Penstemon palmeri*). These species are all native to Zion National Park and will not be impacted by the herbicide. Herbicide, in addition to seeding, was used on this portion of the fire to combat a heavy infestation of cheatgrass which ignited and fueled the Kolob Fire. The application rate of eight ounces of herbicide per acre was recommended to prevent damage to the seeding effort and promote a successful recovery of native plants over the entire fire.

Monitoring is a critical component of this ecosystem restoration project. Our ability to understand ecosystem processes through detecting trends is an essential part of making effective decisions and implementing management actions. The massive restoration efforts involved with the Kolob Fire are being followed up with an extensive monitoring regime. The National Park Service (NPS) and the Northern Arizona University School of Forestry have established a network of plots (Table 1) throughout the restoration area to track changes in vegetation community composition and determine the effectiveness of our chosen actions.

Results

Preliminary results from a collaborative U.S. Geological Survey (USGS)/NPS research project initiated in Zion Canyon in 2005, and funded by the Joint Fire Science Program, have shown that the use of PLATEAU herbicide to combat non-native annual grasses and forbs is most successful if applied during the fall season after a fire disturbance (Figure 4). This disturbance removes excess surface biomass and allows the herbicide to reach the soil surface directly. Direct contact with the soil surface provides more effective absorption and effectiveness of the herbicide.

Discussion

The post-Kolob fire restoration project was the perfect opportunity to expand upon the Zion Canyon research project and try the herbicide application on a larger scale, but we had less than two months to complete the compliance and contracting processes and apply the treatment to get the most effective results. The primary concern after the Kolob Fire was the

Table 1. A plot design and layout scheme was developed to monitor the effects of the herbicide and seeding treatments over a four-year period. This project was designed in conjunction with the restoration efforts to determine effectiveness of the treatments on the burned area and track the recovery process of the affected plant communities and ecosystems.

Study Area within Kolob Fire	Vegetation Type	Plot Design	Plot Size (m)	Number of Replicated Blocks
Kolob Terrace Road	pinyon /juniper	blocks of 4 plots; control, seeded. sprayed, seeded & sprayed	30 x 5	12
Lower Dalton Wash	grassland / shrubland	paired plots; control & spray	2 x 2	22
Upper Dalton Wash	pinyon /juniper	paired plots; control & spray	30 x 5	22

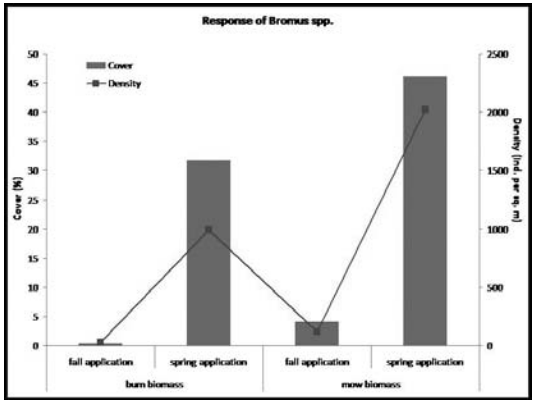

Figure 4. The Kolob Fire rehabilitation project incorporated aerial herbicide and seeding application by helicopter and is the largest such undertaking in National Park Service history. Contract crews (United Agri Products and Northstar Helicopters) worked on the project for two weeks to complete prescribed treatments on over 10,000 acres of NPS land. Herbicide application on the Kolob Fire was a detailed process. Terrain features provided a challenge to helicopter pilots. Effectiveness of the herbicide relies on the application rate of the spraying. The droplet size created by the helicopter spray boom nozzles was adjusted to provide even application of the herbicide over the entire area of the fire.

dominance of cheatgrass, which increases in abundance and density after fire, resulting in increased fuel loads. This, in turn, promotes a plant community prone to frequent fires. Cheatgrass displaces native grasses and herbaceous plants because, as a winter annual, it is able to establish earlier in the growing season and is very competitive for resources such as soil moisture (Billings 1994). Native plants are eventually crowded out because they cannot compete effectively for environmental resources such as space, water, and sunlight.

Monocultures of cheatgrass limit biodiversity, and significantly affect the structure and function of an ecosystem. As cheatgrass continues to increase after each fire, the time between fires becomes shorter (Young et al. 1987). Since native shrubs and trees are slower to re-establish after fire and cannot compete effectively for resources, the increased fire frequency fueled by cheatgrass eventually eliminates most of them from the landscape (Brooks 1999). With cheatgrass dominance, wildfires tend to occur earlier in the season when native perennials are more susceptible to injury by burning. The result is a conversion from native shrub and perennial grasslands to annual grasslands adapted to frequent fires. This adaptation to and promotion of frequent fires is what gives cheatgrass its greatest competitive advantage in ecosystems that evolved with less frequent fires. Cheatgrass expansion has dramatically changed fire cycles and plant and animal communities over vast areas of the West by creating an environment where fires are easily ignited, spread rapidly, cover large areas, occur frequently, and are more intense (Reid et al. 2006).

Conclusion

This landscape-scale restoration effort will be used to learn more about the potential of such actions and share our understanding with the larger agency and private land management community throughout the western United States. We are looking forward to the results from our first year of monitoring.

References

Billings, W.D. 1994. Ecological impacts of cheatgrass and resultant fire on ecosystems in the western Great Basin. In *Proceedings—Ecology and Management of Annual Rangelands,*

May 18–22, 1992, Boise, Idaho. S.B. Monsen and S.G. Kitchen, eds. General Technical Report INT-GTR-313. Ogden, Utah: U.S. Forest Service, Intermountain Research Station, 22–30.

Brooks, M.L. 1999. Alien annual grasses and fire in the Mojave Desert. *Madrono* 46:1, 13–19.

Reid, C.R., S. Goodrich, and J.E. Bowns. 2006. The history and ecology of Cheatgrass (*Bromus techtorum*) and red brome (*Bromus madritensis* subs. *rubens*) in the western U.S. Paper presented at the Fourteenth Wildland Shrub Symposium, Shrublands Under Fire: A Disturbance and Recovery in a Changing World, Southern Utah University, Cedar City, Utah.

Vollmer, J.G, and J.L. Vollmer. 2006. Controlling cheatgrass in winter range to restore habitat and endemic fire. Paper presented at the Fourteenth Wildland Shrub Symposium, Shrublands Under Fire: A Disturbance and Recovery in a Changing World. Southern Utah University, Cedar City, Utah.

Young, J.A., R.A. Evans, R.E. Eckert, Jr., and B.L. Kay. 1987. Cheatgrass. *Rangelands* 9:6, 266–270.

Young, J.A., and R.A. Evans. 1978. Population dynamics after wildfires in sagebrush grasslands. *Journal of Range Management,* 31:4, 283–289.