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Fact Sheet: Effects of Second-entry Prescribed Fire in Unharvested Mixed Conifer Forest November 2012

## Assessing Restoration Objectives Following a Second-entry Prescribed Fire in an Unharvested Mixed Conifer Forest

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### Introduction

Efforts to restore degraded forest ecosystems often involve thinning small-diameter trees and reintroducing surface fire; however, in some areas, such as national parks, mechanical tree thinning is kept to a minimum. In these situations, prescribed fire is the best tool available to restore historical fire regimes and forest structure over broad spatial scales. Multiple prescribed fires are often needed to achieve long-term management objectives, but little information is available about the effects of second-entry burns in mixed conifer forests.

In 1993, a prescribed fire in a dense, unharvested mixed conifer forest in Grand Canyon National Park (GCNP) escaped prescription and burned with greater intensity than anticipated. ERI researchers initially measured the site in 1999 and concluded that the ecological outcome of the Northwest 3 fire was not inconsistent with ecological restoration goals for this ecosystem type (Fulé et al. 2004). In this study, ERI researchers assessed if GCNP restoration and management objectives — including minimizing mortality of large trees, maintaining low seedling and sapling densities, and further reducing surface fuel loadings — were achieved following a second prescribed burn, which occurred in 2007.

### Research Findings

- The surface fire had little effect on large overstory ponderosa pine, Douglas-fir, and white fir trees and did not change total tree density or basal area.
- The fire reduced the overall density of conifer seedlings <12 inches tall by 87%, but had a smaller effect on conifer seedlings >12 inches tall and on sapling density.
- Aspen was the only species with regeneration >12 inches tall that exhibited significant mortality.
- The fire reduced litter depths by 33%, duff depths by 23%, fine woody debris by 21%, and coarse woody debris by 44%.



**Figure 1.** This unharvested mixed conifer forest on the north rim of Grand Canyon National Park was burned with prescribed fire twice (1993 and 2007) after nearly 114 years of fire exclusion. This resulted in a more resilient ecosystem — one with the ability to resist damage and recover quickly following a disturbance — with relatively open forest conditions. Photo by John Paul Roccaforte.

The Ecological Restoration Institute is dedicated to the restoration of fire-adapted forests and woodlands. ERI provides services that support the social and economic vitality of communities that depend on forests and the natural resources and ecosystem services they provide. Our efforts focus on science-based research of ecological and socio-economic issues related to restoration as well as support for on-the-ground treatments, outreach and education.

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## Management Implications

- GCNP's post-burn objectives were met for limiting tree mortality and for reducing conifer seedling density, litter and duff depth, and coarse woody debris loadings.
- Management objectives were not met for reducing conifer sapling density and fine woody debris loadings.
- Although aspen recruitment was significantly reduced, it is expected that aspen will continue to flourish, given aspen's tendency to sprout vigorously after a fire.
- Despite the fact that a few specific objectives were not met, GCNP managers feel that these fires achieved overall restoration goals and now consider this forest to be in "maintenance burning," meaning they plan to allow natural ignitions to maintain forest structure in the future (Figure 1).
- This example illustrates that use of prescribed fire in a ponderosa-pine dominated mixed conifer forest can be consistent with restoring historical conditions (i.e., relatively open forest structure with frequent surface fires) and with managing for resilience under current and future conditions.

## References

Fulé, P.Z., A.E. Cocke, T.A. Heinlein, and W.W. Covington. 2004. Effects of an intense prescribed forest fire: Is it ecological restoration? *Restoration Ecology* 12(2): 220-230.

Visit <http://eri.nau.edu/en/arizona/grand-canyon-northwest-3-burn-only-treatment-study> to view a slide show and video of the Grand Canyon National Park Northwest 3 study site.

### **This Fact Sheet summarizes information from the following publication:**

Laughlin, D.L., J.P. Roccaforte, and P.Z. Fulé. 2011. Effects of a second-entry prescribed fire in a mixed conifer forest. *Western North American Naturalist* 71 (4):557-562. <http://library.eri.nau.edu/gsd/collect/erilibra/index/assoc/HASH0167.dir/doc.pdf>

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