Ecological Restoration Institute

Fact Sheet: Pinyon-Juniper Woodland Recovery December 2010

Dead Wood Plays Important Roles in Pinyon-Juniper Woodland Recovery After Wildfire

Stand-replacing crown fires appear to be consistent with historical patterns of natural disturbance in some pinyon-juniper woodlands of the American Southwest, Colorado Plateau, and Great Basin. These moderate- to high-severity fires result in the death of most or all trees across areas that range from small groups of a few trees to hundreds of acres. In some forest ecosystems, logs remaining after fire are known to reduce soil movement and increase retention of soil nitrogen. In studies of pinyon-juniper management, woody material created by tree thinning has been shown to enhance plant establishment and affect soil moisture and chemistry (Stoddard and others 2008). Logs and standing dead trees also can be important habitat for various animals. It follows that this dead material may influence vegetation patterns over long periods of time through numerous effects on soils, microclimate, and wildlife habitat. Presently, there is extremely little information available concerning dead wood amounts after fire and the influence this material may have on patterns of vegetation development. Lack of information leads to uncertainty in determining appropriate management responses to severe fires in pinyon-juniper ecosystems. In this case study (Huffman and others in revision), we were interested in quantifying dead wood amounts and analyzing tree recruitment patterns and vegetation patterns 30 years after a severe fire in a northern Arizona pinyon-juniper woodland.

Research Findings

- Numbers and sizes of dead structures suggested the site had been previously occupied by persistent woodland. Such conditions develop in the absence of severe disturbance over the course of centuries.
- Thirty years after the Yellow Jacket Fire, an average of 18 standing, dead trees per acre remained and the mass of sound and rotten logs was 2.6 and 0.7 tons per acre, respectively.
- Plots showed relatively high cover (8.1-8.6%) of shrubs and moderate cover (3.6-4.2%) of grasses. Tree cover averaged 1.5%.
- Tree-ring analysis indicated that most juniper regeneration occurred within ten years of the fire event. Pinyon pine regeneration was minimal.
- Correlation analysis showed strong positive relationships between number of regenerating trees, number of shrubs, and number of dead trees on plots.
- Minimum distance from live tree regeneration to dead wood averaged 4.6 ft (1.4 m) and about 30% of all live trees were found within about 1 foot of dead wood. Similar associations were observed between shrubs and dead wood.
- Spatial analyses suggested weak aggregation of tree regeneration and dead wood, and stronger aggregation of shrubs and dead wood, and live trees and shrubs.

Management Implications

- Vegetation development after fire in pinyon-juniper ecosystems is highly variable and likely depends upon the interactions of pre-fire conditions, fire severity, and post-fire legacies (e.g., dead, woody material).
- Although juniper trees may begin to reestablish soon after fire, woodland conditions may take many decades or even centuries to develop.
- The amount and condition of dead trees and logs remaining on a pinyon-juniper site after fire appears to help plants establish by modifying microclimate, soil conditions, and providing habitat for animal seed dispersers.
- The resilience of these ecosystems may depend upon conservation of dead, woody material.

The Ecological Restoration Institute is dedicated to reversing declines in the condition of forested communities throughout the Intermountain West, particularly those affected by severe wildfires and insect outbreaks. Our efforts focus on science-based research of ecological and socio-economic matters related to restoration as well as support for on-the-ground treatments, outreach, and education.
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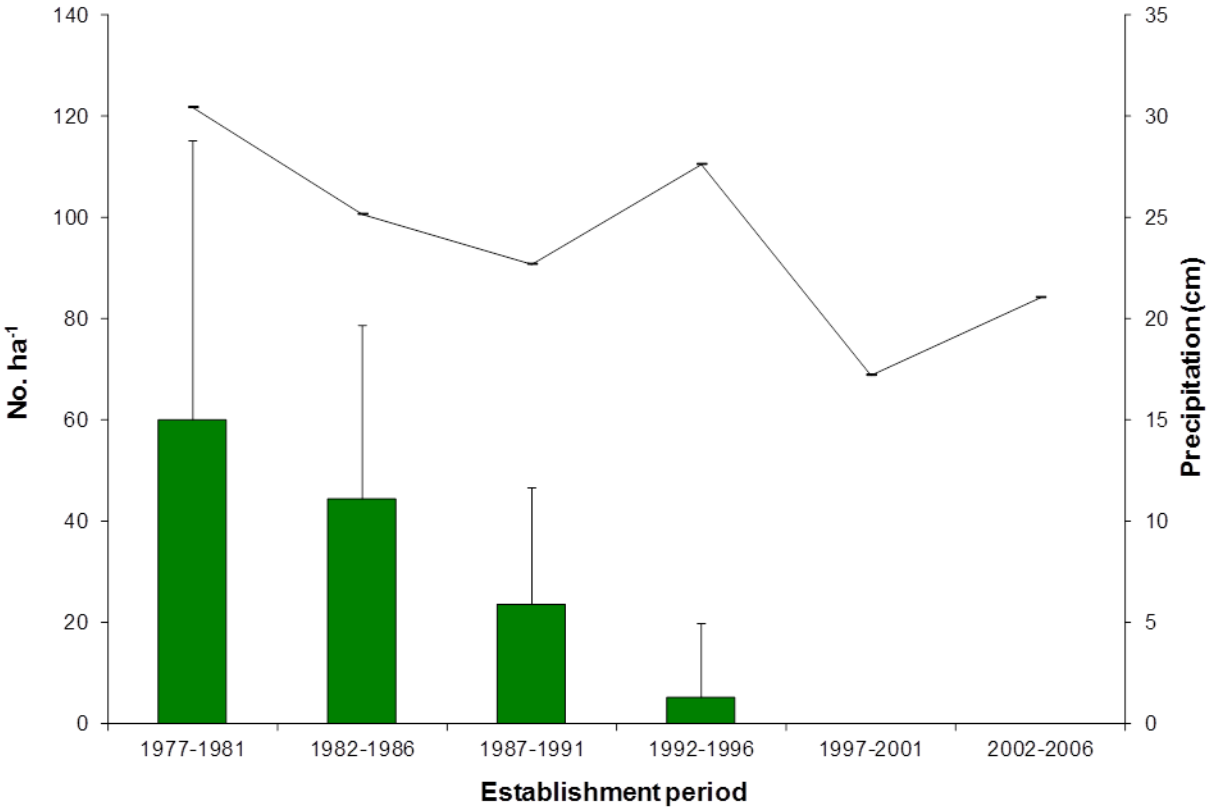

Juniper regeneration (green bars) displayed in five-year age classes. This pattern shows that the majority of trees re-established with ten years of the stand-replacing fire (1977). Also shown is average growing season precipitation for the five-year periods. Processes influencing re-establishment of trees after severe disturbance are complex and more work is needed to determine the role of dead woody material in modifying microsite conditions and facilitating tree regeneration.

References

Huffman, D.W., A.J. Sanchez Meador, and J.E. Crouse. *In revision*. Coarse woody debris and vegetation 30 years after stand-replacing fire in a pinyon-juniper woodland. Available by e-mailing: David.Huffman@nau.edu

Stoddard, M.T., D.W. Huffman, T.M. Alcoze, and P.Z. Fulé. 2008. Effects of slash on herbaceous communities in pinyon-juniper woodlands of northern Arizona. *Rangeland Ecology and Management* 61:485-495.

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