



# Evidence-based Restoration Systematic Review



Effectiveness of Post-wildfire Seeding in Western U.S. Forests

March 2011

## Background

Broadcast seeding is one of the most widely used emergency treatments after a wildfire in forested ecosystems of the western United States. It is intended to reduce soil erosion, increase vegetative ground cover, and minimize establishment and spread of non-native plant species. However, seeding treatments can have negative effects, including competing with recovering native plant communities and inadvertently introducing invasive species.

**Primary question:** Does seeding after severe forest fires mitigate negative impacts on soils and plant communities?

**Secondary questions:** Does seeding after severe forest fires reduce soil erosion? Is seeding effective at reducing non-native plant invasion into burned areas? Does post-wildfire seeding affect native plant community recovery?

## Methods

This systematic review was conducted following the Centre for Evidence-Based Conservation guidelines at: <http://www.environmentalevidence.org/Authors.htm>.

## Results

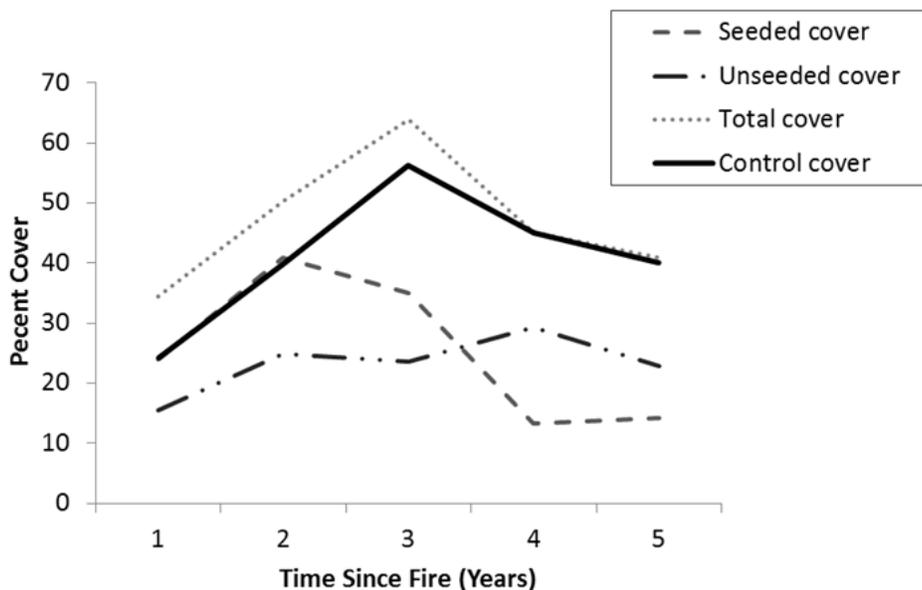
In our review, we found 94 relevant studies. The majority of studies (64%) evaluating soil erosion in seeded plots and unseeded controls showed that seeding did not reduce erosion relative to unseeded controls. Comparing cover measurements between seeded and unseeded plots from 20 studies containing a total of 29 study sites, we found that even when seeding significantly increased vegetative cover, seeded sites rarely supported sufficient plant cover to stabilize soils in the first and second year post-fire (Table 1).

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**Table 1 – Number of sites, by ecoregion, in published studies reporting measures of seeding “success” during the first two years following a wildfire.**

Sites Showing Cover Measurements	Those Showing Seeding Significantly Increased Cover	% of Sites Showing 30-60% Cover (No. of Sites)		% of Sites Showing > 60% Cover (No. of Sites)		Sites Showing Erosion Measurements	Those Showing Seeding Significantly Reduced Erosion
		Seeded	Unseeded	Seeded	Unseeded		
-----No.----- Percent -----No.-----							
Post-wildfire Year One							
Marine Regime Mountains	6	33 (2)	17 (1)	0	0	5	0
Temperate Steppe Regime Mountains	8	50 (4)	50 (4)	0	0	4	0
Tropical/Subtropical Regime Mountains	3	100 (3)	100 (3)	0	0	0	—
Mediterranean Regime Mountains	12	58 (7)	8 (1)	33 (4)	0	3	0
<b>Combined</b>	<b>29</b>	<b>55 (16)</b>	<b>31 (9)</b>	<b>14 (4)</b>	<b>0</b>	<b>12</b>	<b>0</b>
Post-wildfire Year Two							
Marine Regime Mountains	4	100 (4)	75 (3)	0	0	5	0
Temperate Steppe Regime Mountains	7	71 (5)	71 (5)	0	14 (1)	5	1
Mediterranean Regime Mountains	7	86 (6)	14 (1)	71 (5)	0	0	0
<b>Combined</b>	<b>18</b>	<b>83 (15)</b>	<b>50 (9)</b>	<b>28 (5)</b>	<b>6 (1)</b>	<b>10</b>	<b>1</b>

Of the 11 papers providing direct evidence regarding the role of seeding in reducing non-native species abundance, an almost equal number found seeding treatments to be effective (six studies) or ineffective (five studies). However, the majority of effective and ineffective treatments (83% and 80%, respectively) used non-native species causing negative impacts on native communities. A majority of studies reported that seeding suppressed recovery of native plants (62%, 16 studies). Data on long-term impacts of this reduction are limited, however. Cover data from 15 studies containing 57 different study sites showed decreased seeded cover relative to control plot cover with increasing time since fire. Cover data from all 57 sites indicates that total plant cover in seeded sites and controls was nearly identical by years 4 and 5 post-wildfire (Figure 1).



**Figure 1. Average seeded cover (seeded species only), unseeded cover (seeded plots), total cover (seeded + unseeded species), and total control cover (unseeded) versus time since fire (data from 57 sites contained in 15 studies assessing post-wildfire seeding treatment performance in forested ecosystems in the western U.S.).**

### Management and Research Recommendations

These findings suggest that post-fire seeding is not reliably effective in protecting soil in the short term and can have negative consequences for native plant recovery. Seeding with annual, non-native species can be effective in curtailing invasive non-natives, but is often associated with slower native plant recovery. Land managers should weigh the costs and benefits of seeding treatments, and consider using alternative rehabilitation methods shown to be more effective (e.g., mulching). Early detection of new, undesirable species invasions through monitoring post-fire environments in combination with rapid response methods to quickly contain, deny reproduction and eliminate these invasions, may allow better control of non-native species establishment than is typically obtained through seeding. Plant community recovery may be improved with the use of locally adapted, genetically appropriate plant materials, although more research regarding the effects and effectiveness of these species is critical.

The effectiveness and long-term effects of post-fire seeding deserve further study, particularly well-designed research experiments and rigorous quantitative monitoring to evaluate seeding success. Studies assessing the use of native species to counter non-native species invasions in burned areas are almost non-existent. Taking a closer look at the use of native species to reduce non-natives would be valuable. Further quantitative research on the effects of mulching after wildfire is also essential. Given on-going debates about seeding, additional research that studies the long-term effects of seeding with both native and non-native species on natural vegetation recovery and the genetic integrity of native populations is essential.

### Reference and Links

The full systematic review and all references can be accessed at:  
<http://www.eri.nau.edu/en/evidence-based-restoration-projects>