Brushfires in California Wildlands: Ecology and Resource Management
Edited by J.E. Keeley and T. Scott. 1995. International Association of Wildland Fire, Fairfield, WA.

Postfire Management: Workshop Summary

Jon E. Keeley

Postfire management of Californian brushlands is of great concern to many people. One of the primary values of these ecosystems is as watersheds that protect water resources and reduce threats of winter floods. Wildfires, which eliminate the aboveground vegetation, increase sedimentation and erosion from these slopes and increase the threat of downstream floods and debris flows. There is widespread agreement among experts that, while further research is required to clarify certain postfire management issues, we do have a database sufficient to make recommendations on the ecological and economic effects of postfire rehabilitation procedures such as aerial seeding.

Wildfires are a natural feature of California shrublands. Plants in these ecosystems exhibit the capacity, under most conditions, to rapidly reestablish. This natural built-in "restoration program", however, does not eliminate the threats to downstream resources by flooding and the consequent debris flows that can be initiated by this flooding. It is important that persons living in the wildland/urban interface recognize that postfire sediment movement is a natural feature of these ecosystems.

It is increasingly evident that seeding of ryegrass or other species, does not reliably reduce erosion from burned hillslopes and cannot be relied upon to reduce significantly the threat of downstream loss of resources. The primary reason is that in order for seeded species to be effective, seeds must germinate early and plants develop rapidly, prior to major winter storms. Numerous studies have shown that in most years, autumn rains, particularly in southern California and the Sierra Nevada foothills, are insufficient to generate significant plant cover prior to major winter storms. In some years favorable weather conditions may result in successful establishment with some potential for slowing hillslope erosion. However, since seeding must be done prior to the rainy season, it is never possible to anticipate which years will provide conditions suitable for effective establishment.

Under some circumstances seeding is not a viable option regardless of rainfall patterns. In particular, watersheds with steep slopes (>35°) generally do not provide suitable stable substrate for grass establishment. These are also the watersheds most susceptible to major sediment losses, and are known to produce flood events with rainfall intensities as low as a quarter of an inch in fifteen minutes. If, under these low intensity rainstorms, sufficient overland flow exits to initiate flooding or debris flows, then there is increased likelihood that seeds will be washed downslope even in the smallest of storm events.

On shallower slopes, under ideal conditions, seeding may reduce sedimentation resulting from sheeting erosion and rilling. However, no studies have demonstrated that seeding results in any measurable increase in protection from flooding and debris flows. This is because the principal forms of soil loss are dry ravel and the concomitant build up of colluvium and streambed sediment loading, and this occasionally leads to disastrous outwash mudflows. These sources of soil loss occur immediately following a fire and thus are not effectively dealt with by seeding.

Any significant increase in slope stability, over that provided by natural regeneration, is likely to occur only under conditions where natural regeneration is impaired. This could come about following fires of particularly high intensity, which may reduce the natural soil seed bank and affect other soil properties. Further research is needed to determine the conditions of fire severity that result in diminished natural recovery.

Under conditions where establishment of seeded species is good, threats to natural recovery need to be considered. Available scientific evidence indicates that ryegrass may competitively displace the natural regeneration. As seeding success increases on a site, natural recovery and diversity is threatened, both through direct competition and indirectly by increasing the potential for reburns in subsequent postfire years. A reduction in

shrub seedling establishment could have long-term impacts on dry ravel production and increased potential for future debris flows. Further research is needed to fully ascertain the extent of this threat.

In response to these environmental concerns about seeding with non-native ryegrass, some resource managers have utilized seed mixtures with native species. Before seeding of native species can be generally recommended, more study is needed. Problems that should be addressed include:

1. The native status of recommended species needs to be confirmed; for example there is a mistaken belief that zorro fescue is native.

2. Attention needs to be given to determining whether species are native to the site. It would be inadvisable to utilize native species if they do not normally establish in burned habitats; for example, recruitment of native grasses is rare on recently burned sites.

3. The ecological consequences of broadcasting natives into situations where their natural occurrence may be low or zero needs to be determined. For example, some species are found almost exclusively on south facing slopes. Their introduction onto north slopes by seeding may either result in low establishment or in undesirable competitive interactions with the north slope plant species.

4. The genetic effects of seeding must be considered, as introduction of non-local seeds may swamp local genotypes, or "outbreeding depression" may reduce seed set or the vigor of the subsequent generations.

5. The feasibility and costs of maintaining proper seed stocks for native species are potential obstacles that may be very difficult to overcome.

In conclusion, it is important to recognize that seeding with native or non-native species is likely to provide an unreliable (and often unmeasurable) reduction in sediment yields. Where significant downstream resources are at risk, seeding under most conditions can not be counted on to significantly reduce hillside erosion after wildfires. Further research is needed to determine when this technique is appropriate as well as cost-effective, and to determine its potential for long-term ecological impacts on chaparral and coastal sage ecosystems. Mechanical solutions to postfire flooding and mudflows, such as straw bale check dams, k- bars to channelize mudflows, debris basin construction, or hydromulching without seed, may ultimately prove to be more reliable than aerial seeding. Such techniques also may be far less disruptive to natural ecosystem processes, however, a thorough evaluation of the cost effectiveness of these techniques is needed.

Acknowledgments. I thank the following workshop participants for contributing comments to this overview: Jan Beyers, Fred Booker, Mark Borchert, Bill Brown, Susan Cochrane, Susan Conard, Dave Dyer, Richard Erickson, Scott Franklin, Boyd Gibbons, Todd Keeler-Wolf, David Magney, Dan Silver, Bob Slayback, Thomas Spittler, Scott White, Thomas White, Douglas Wickizer, and Paul Zedler.