Expected Vegetation Recovery of the Cedar Fire

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Based on the following information and studies, the probability that the vegetation will recover rapidly, without any treatment, is high. Natural revegetation is expected to reduce erosion and overland waterflow in high hazard areas. The following information is derived from the Fire Effects Information System (FEIS 2003) except where otherwise noted.

Tree Recovery

Most of the canyons and riparian areas, and higher elevation areas within the fire support Coast Live Oak (*Quercus agrifolia*), Engelmann Oak (*Quercus engelmannii*), Black Oak (*Quercus kelloggii*), or Scrub Oak (*Quercus berberidifolia*) woodland. A few areas such as the San Diego River are vegetated with cottonwood (*Populus fremontii*), sycamore (*Platanus racemosa*), and willow trees (*Salix* spp.) All of these tree and shrub species resprout vigorously from roots after fire. Coast Live Oak is a fire-resistant tree that is usually not top-killed even by high-intensity fire; it resprouts from surviving crowns and trunks.

The upper portions of canyons and slopes support stands of Jeffrey Pine (*Pinus jeffreyi*), Coulter Pine (*Pinus coulteri*), and California Incense Cedar (*Calocedrus decurrens*). All of these species have some resistance to fire - especially Incense Cedar - and all recruit vigorously from seed after a fire.

Shrub Recovery

All chaparral species have the ability to regenerate rapidly after fire through seed germination or resprouting (Keeley 1977). Fire usually kills seeds on the soil surface. However, buried seeds remain insulated from extremely high temperatures, provided that the soil is relatively dry (summer and fall conditions). Some seeds, especially those of ceanothus and fire-following herbs, only germinate after fire. Chaparral species that are obligate seeders after fire are resilient to fire-free intervals of 100 years or more (Keeley, 1976). Some of these species germinate in response to fire-related opening of the seed coat, while others respond to chemicals in the ash.

Moreno and Oechel (1991) investigated the effect of fire intensity on the germination of shrubs and herbs in chaparral. They piled brush onto established plots prior to burning to achieve different fire intensities. Increasing fire intensities promoted earlier germination of Cupleaf Ceanothus (*Ceanothus greggii*), but resulted in decreased germination of chamise (*Adenostoma fasciculatum*). Amongst herbs, fire-following annuals such as *Phacelia brachyloba* were resistant to increasing fire intensity. Deerweed (*Lotus strigosus*) was stimulated by all levels of increased fire intensity.

In the Cedar Fire, the chaparral that burned was dominated by Chamise (*Adenostoma fasciculata*), Manzanita (*Arctostaphylos glandulosa*), and Scrub Oak (*Quercus berberidifolia*). All of these species sprout vigorously after fire. Minor components of Whitebark Ceanothus (*Ceanothus leucodermis*), Redshank (*Artemisia sparsifolia*),

California Sage (*Artemisia californica*), and Buckwheat (*Erigonum fasciculatum*) were also present. Whitebark Ceanothus, Redshank, California Sage, and Buckwheat are strong sprouters and also regenerate from seed after fire.

Herbaceous Vegetation Recover

In the first spring after a fire there is abundant growth of deciduous semi-woody and herbaceous plants that arises from the seed bank or from underground rhizomes or bulbs. Keeley et al. (1981) studied first year post-fire herbaceous cover within the perimeter of the Laguna and Boulder Fires in San Diego County. These fires occurred during late September and early October in 1970. Average herbaceous cover measured between 30 and 80 percent. Common native species included annual snapdragon (Antirrhinum coulterianum), pincushion flower (*Chaenactis artemisiaefolia*), popcorn flower (*Cryptantha intermedia*), and annual lotus (*Lotus salsuginosus*).

Personal observations of post-fire recovery after the Warner Fire, which burned 3,000 acres in 1995, the Ortega Fire, which burned 10,000 acres of the Cleveland National Forest in 1993, and of recovery from the Vail Fire which burned 10,000 acres on the Palomar Ranger District in 1989, indicate that recovery of herbaceous vegetation after fire is rapid and abundant. Cover values of 70% or greater were observed during the spring following the fire, even in areas where the burn intensity was high (see photo files, Cleveland National Forest).

Herbaceous species that can be expected to be abundant after the Cedar Fire include Morning Glory (*Calystegia macrostegia*), Popcorn Flower (*Cryptantha intermedia*), Whispering Bells (*Emmenanthe penduliflora*), *Phacelia* (several species), Stinging Lupine (*Lupinus hirsutissimus*), Needlegrass (*Achnatherum speciosum*), and Deerweed (*Lotus scoparius*).

EFFECTS OF SEEDING

Due to the steep and rocky nature of the slopes in the burned area, seeding of the slopes is unlikely to be an effective treatment for maintaining slope stability. In the event that a seeding treatment is selected, adverse effects on the recovery of native vegetation are to be expected.

Seeding with Non-native Annual Grasses

Chaparral is a fire-adapted plant community that typically burns in high-intensity crown fires. In studies of the effects of seeding with annual ryegrass (*Lolium multiflorum*), a non-native grass, unseeded and seeded areas have had similar rates of vegetation recovery and erosion. Conard (1993) studied three Southern California fires over 2 years. Only one site had significantly higher cover in seeded vs. unseeded plots, and her analysis showed "no evidence that the seeding of ryegrass significantly reduced the amount of surface erosion in the post-fire environment at any of the three sites." A study conducted in chaparral in San Diego County obtained similar results (Keeley 1981).

Soil loss is accelerated after fire and the risk of flooding is increased. Wells (1985) studied fires in the San Gabriel Mountains, and found that dry ravel and formation of rill

networks account for most of the increased erosion. In areas where hydrophobic soils were present, large debris flows occurred. As little as 15 mm of rainfall could initiate a flow. According to Rice (1974), almost 70 per cent of the sediment flow from burned watersheds occurs in the first year following fire. Since much of the erosion may occur soon after the fire, and before there has been enough rain to allow seeds to germinate, seeding with ryegrass has little effect on postfire erosion (Wakimoto, 1979; Krammes and Hill, 1963).

Response of Native Vegetation

Many studies have reported the inhibition of chaparral shrubs, conifers, and native herbaceous species by exotic grasses used in fire rehabilitation in Southern California. Nadkarni and Odion (1985) compared seeded areas with unseeded areas. Unseeded plots had higher native species diversity and biomass. Seeding of ryegrass apparently inhibited growth of fire-following herbs (*Helianthemum scoparium, Turricula parryi*) and inhibited shrub seedlings (*Ceanothus crassifolius*). Conard (1993) studied three fires and concluded that in all cases, species diversity was higher on unseeded plots. Seeding appeared to facilitate introduction of other non-native grasses. The Marble Cone Fire on the Monterey District of the LPNF was studied for three years by Griffin (1982). Ryegrass seeding was associated with high mortality of ceanothus shrub seedlings and decreased regeneration of pines. Other researchers have also concluded that ryegrass seeding inhibits the regeneration of native shrubs and herbs (Taskey etal. 1988, Keeley et al. 1981).

Zedler et al. (1983) studied a fire in San Diego County that was seeded with annual ryegrass. Where ryegrass was successfully established, it provided a fuel layer that supported a reburn of the area just one year later. The native shrubs had reseeded and sprouted after the first burn, but nearly all were killed by the second fire. This resulted in a type conversion of the area from native chaparral to non-native grassland.

Coast Live Oak trees are expected to recover naturally. However, seeding treatments could impede this recovery. Studies have demonstrated that annual grasses inhibit seedling growth which results in reduced oak regeneration rates (Borchert et al. 1988, Danielsen and Halvorson 1990). The effects of broadcasting seed of non-local native plants is unknown, but the potential exists for non-local native plants to produce similar results.

REFERENCES

Borchert, M., F.W. Davis, J.C. Michaelsen, L.D. Oyler. 1989. Interactions of factors affecting recruitment of blue oak (*Quercus douglasii*) in California. *Ecology* 70:389-404.

Conard, S. 1993. The effects of fire and post-fire rehabilitation measures on surface erosion and vegetation development in California chaparral. Work Plan No. 8, 1993-94 Fiscal Year. Agreement 8CA53048(PSW-86-CL-031). Los Padres National Forest Files.

Danielsen, K.C. and W.L. Halvorson. 1990. Valley Oak seedling growth associated

with selected grass species. In: Proceedings of the symposium on oak woodlands and hardwood rangeland management. Gen Tech Report PSW-126, USDA Forest Service.

Fire Effects Information System. 2003. Online database at http://www.fs.fed.us/database/feis/

Griffin, J.R. 1982. Pine seedlings, native ground cover, and *Lolium multiflorum* on the Marble Cone burn, Santa Lucia Range, California. *Madrono* 29: 177-188.

Keeley, S.C., J.E. Keeley, S.M. Hutchinson, A.W. Johnson. 1981. Postfire succession of herbaceous flora in southern California chaparral. *Ecology* 62(6):1608-1621.

Keeley, J.E. 1977. Seed production, seed populations in soil, and seedling production after fire for two congeneric pairs of sprouting and non-sprouting chaparral shrubs. *Ecology* 58:820-829.

Keeley, J.E. 1976. Resilience of mediterranean shrub communities to fires. In *Resilience in mediterranean-type ecosystems*. B. Dell, ed. DR W Junk Publishers, Boston. 168 pp.

Krammes, J.S. and L.W. Hill. 1963. First aid for burned watersheds. Research Note PSW-29, Pacific Southwest Range and Experiment Station, Berkeley, CA.

Moreno, J.M. and W.C. Oechel. 1991. Fire intensity effects on germination of shrubs and herbs in Southern California chaparral. *Ecology* 72(6):1993-2004.

Nadkarni, N.M. and D.C. Odion. 1985. Effects of seeding an exotic grass *Lolium multiflorum* on native seedling regeneration following fire in a chaparral community. In: *Proceedings of the Chaparral Ecosystems Management Conference*. California Water Resources Center, Univ. of Calif, Davis.

Rice, R.M. 1974. The hydrology of chaparral watersheds. In M. Rosenthal (ed.) *Symposium on living with the chaparral-Proceedings*. Sierra Club, San Francisco, CA.

Taskey, R.D., C.L. Curtis, and J.Stone. 1988. Wildfire, Ryegrass seeding, and watershed rehabilitation. In *Proceedings of the symposium on fire and watershed management*. USDA Forest Service General Technical Report PSW-109.

Wakimoto, R.E. 1979. Major points against the use of annual ryegrass (*Lolium multiflorum*) for emergency revegetation of burned chaparral watersheds. *CHAPS Newsletter, Chaparral Research and Development Program*. Pacific Southwest Forest Fire Lab, Riverside, CA.

Wells, W.G. 1985. The influence fo fire on erosion rates in California chaparral. In: *Proceedings of the Chaparral Ecosystems Management Conference*. California Water Resources Center, Univ. of Calif, Davis.

Zedler, P.H., C.R. Gautier and G.S. McMaster. 1983. Vegetation change in response to extreme events: the effect of a short interval between fires in California chaparral and coastal scrub. *Ecology* 64:809-818.

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