Nourished by WILDFIRE

Black-backed woodpecker
Picoides arcticus

The Ecological Benefits of the Rim Fire and the Threat of Salvage Logging

Center for Biological Diversity and the John Muir Project • January 2014

Executive Summary

The Rim fire began on Aug. 17, 2013, near the confluence of the Clavey and Tuolumne rivers about 20 miles southeast of Sonora, Calif., and eventually burned across approximately 257,000 acres in the central Sierra Nevada Mountains. The fire occurred on private timberland, the Stanislaus National Forest and Yosemite National Park, and burned through a variety of vegetation types, including low-elevation shrub and foothill-oak habitat and low- and mid-elevation conifer forest. An illegal campfire set by a hunter is believed to have initiated the event. No lives were lost as a result of the fire.

Significant media attention has been given to the Rim fire, due primarily to its large size. Media accounts have mostly portrayed it in a negative light, using pejorative terms such as referring to the burned area as a "moonscape" or "nuked."[1]

"Burned forests are not dead zones, but rather teem with life."

In the same vein, the immediate reaction by Forest Service managers has been to log the burned area to "salvage" the wood from trees that were burned. The Forest Service recently issued a "recovery and rehabilitation" proposal that includes logging approximately 30,000 acres in areas where public safety is not an issue

Burned forests are not dead zones, but rather teem with life . The reflex reaction to log after forest fires directly contradicts decades of scientific research showing both the immense ecological importance of post-fire landscapes and the significant harm that can occur when such areas are logged. Forest fires like the Rim fire are essential to maintain biological diversity in the Sierra's ecosystems, and burned and dead trees provide critical habitat to numerous wildlife species. Of course, a legitimate public-safety exception is warranted to protect the public from falling trees in heavily traveled corridors.

This report analyzes the Rim fire in relation to the relevant biological science and recommends: **Rather than industrial scale salvage logging, post-fire management should focus on activities that benefit forest health, water quality and the many species that depend upon fire for their very existence.**

Burned Forests Are Ecologically Important and Should Not Be Logged

Fire — including high-intensity fire — is an essential component of the Sierra Nevada ecosystem. In fact, fire historically burned vast amounts of the Sierra landscape on an annual basis prior to the Forest Service's fire-suppression policies.[2]

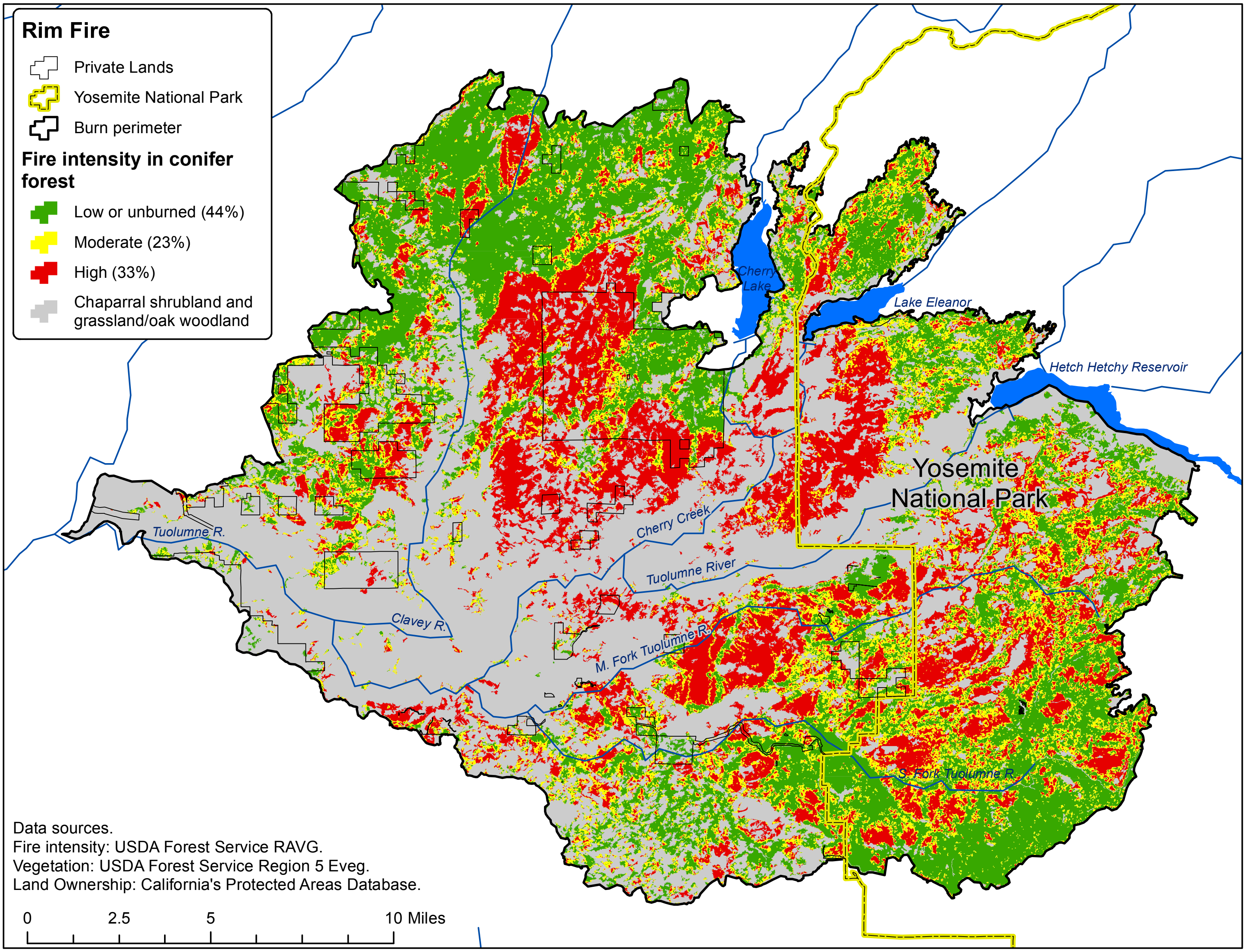
Forest fires — particularly those that burn at moderate and high intensities — are often perceived by the public as catastrophic events. Perception becomes reality when there is a loss of human life as a result of fire. But intense fires in wildland areas — away from human development — are both natural and necessary to maintain the integrity of dynamic, disturbance-adapted forest systems. Wildland fires create the ecologically critical first stage in the multi-century life of a forest. This stage creates habitat that the plants and animals of the Sierras have evolved with for millennia, and on which many species depend.

This first stage of the forest will last for several decades from the time of the disturbance event until the forest canopy returns. To the uninitiated, a forest immediately after a fire may look like a barren landscape of charred standing dead and downed trees, but ecologically, the remaining dead structure and surviving organisms — such as shrubs and plants, seeds and spores, fungi, and remaining trees, including standing dead trees (snags) and live and downed trees — are scientifically known as "biological legacies." Not only have many species evolved to depend upon these legacies, they are essential for the health and function of the newly growing forest. When these post-disturbance legacies are allowed to remain intact — i.e., are not logged or otherwise artificially disturbed — what develops is known as "complex early seral forest" (CESF).

Wildland fires create the ecologically critical first stage in the multi-century life of a forest.

Sierra Nevada, Tahoe National Forest, 7 years post-fire in an unlogged area, snags and fireweed (a common native plant often found in post-fire areas).

In the Sierra Nevada region, complex early seral forests are both extremely rare and critically important.[3] Scientific research has documented the rich biodiversity of complex early seral forests — some of the highest levels of species diversity are found in naturally regenerating areas created by high-intensity wildfire. In the Sierras, the standing dead trees, or snags, as well as the wildflowers and bushes that grow soon after high-intensity fire, provide essential habitat to many species of wildlife, such as, for instance, wood-boring beetles and their vociferous consumers, black-backed woodpeckers. The residual biomass of CESFs also provides for the rapid proliferation of new life.[4] For example, new wildflower cover, grasses and shrubs — especially nitrogen fixers such as *Ceanothus* — are common in post-fire areas created by high-intensity fire.

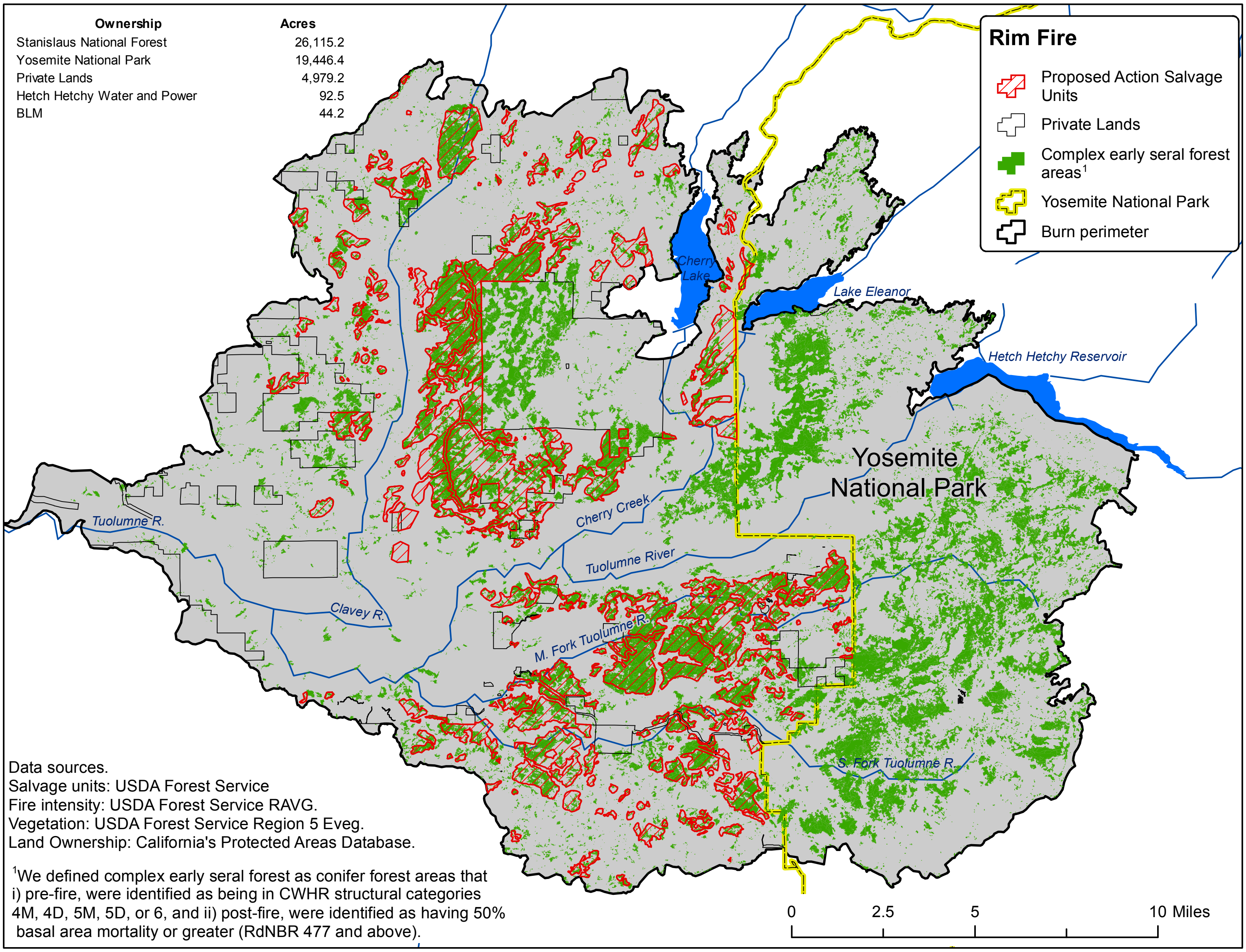


Map 1. Fire Intensity in Conifer Forest in the Rim Fire Area

The Rim Fire Created Much-needed Wildlife Habitat

The data shows that the Rim fire restored fire to several vegetation types, including significant amounts of non-forested areas. While media coverage has focused on the burning forest, approximately 40 percent of the Rim fire (104,000 acres) burned in non-forested areas in the lower-elevation foothills that consist primarily of chaparral shrubland and grassland, as well as oak woodlands. Low-elevation shrub habitat such as ceanothus and manzanita generally requires stand-replacing fire to germinate and reproduce most effectively.[5] Species like black oaks are not killed by fire, even high-intensity fire. Rather, a new tree will sprout from the base when crown fire occurs and flourish.

The conifer forests that burned in the Rim fire (approximately 153,000 acres) are made up of ponderosa pine, mixed-conifer, white fir, red fir and lodgepole pine. The fire had wide-ranging effects in these conifer forest areas, with patches varying from no mortality to some or even complete tree mortality. As a result the Rim fire created a mosaic of fire severities across the landscape, thereby helping to mitigate the extreme historic fire deficit that exists in the Sierras. Thirty-three percent of the conifer forest burned at high intensity, 23 percent at moderate intensity, and 44 percent at low or no-intensity.



Map 2. Proposed Post Fire Logging Units

The Rim fire created more than 50,000 acres of complex early seral forest habitat, including more than 26,000 acres on the Stanislaus National Forest.[6] But if the Forest Service's salvage logging plans proceed as proposed, most of this rare and critically important CESF habitat type will be destroyed, including most of the post-fire, black-backed woodpecker habitat in the Stanislaus National Forest.[7]

After the Fire: Rejuvenation

Forest rejuvenation begins immediately after the fire goes out and increases in the first spring after the fire. Native wood-boring beetles rapidly colonize burned areas, having detected the fires from miles away through infrared receptors evolved over millennia. The beetles bore under the bark of standing snags and lay their eggs, and the larvae feed and develop there. Woodpeckers such as the rare and imperiled black-backed woodpecker depend upon burned forest habitat and the high-protein food source the beetles provide. One black-backed woodpecker eats about 13,500 beetle larvae every year.

Having evolved with fire, the black-backed woodpecker — which gets its name from its dark-black and charcoal feathers — blends into the burned forest habitat, so it can be very difficult to observe against the charred bark of the dead trees. The woodpeckers create nest cavities in the dead trees that are later used by many other species such as swallows, bluebirds and wrens (and, occasionally, squirrels and even martens) that cannot excavate their own nest cavities.

Recent research in the Sierras shows that black-backed woodpeckers rely heavily on areas with extremely high snag densities, which are primarily found in forest that has burned at high intensity.[8] The black-backed woodpecker is currently being considered for Endangered Species Act protection due to the chronic lack of complex early seral forest in the Sierra Nevada region resulting from fire suppression and post-fire logging.[9]

The complex early seral forest habitat created by high-intensity fire is extremely important for biodiversity. Many species use this rare habitat type, including the olive-sided flycatcher, mule deer, mountain bluebird, California spotted owl, fringed myotis, lazuli bunting, western wood pewee, hairy woodpecker, green-tailed towhee, white-headed woodpecker, pallid bat, fox sparrow and mountain quail.[10]

The native flowering shrubs that germinate after fire attract many species of flying insects, which provide food for flycatchers and bats, and the shrubs, new conifer growth and downed logs provide excellent habitat for small mammals. This, in turn, attracts raptors like the California spotted owl and northern goshawk, which nest and roost mainly in the low/moderate-intensity fire areas or in adjacent unburned forest, but actively forage in the snag forest habitat patches created by high-intensity fire — a sort of "bedroom and kitchen" effect. Deer thrive on the new growth, black bears forage on the rich source of berries, grubs and small mammals in snag forest habitat, and even rare carnivores like the Pacific fisher are active in this post-fire habitat.[11]

Early-successional plants replenish essential nutrients needed for healthy plant growth such as nitrogen, which can be lost during forest fires . The rich diversity of plants also produces a wide variety and high level of food sources such as grasses, shrubs and flowering plants, as well as nectar, seeds and fruits. As these forests have evolved with fire, many animals (including "habitat specialists") thrive in these areas and are crucial in helping to restore the natural processes of a redeveloping forest.

> *Many . . . [bird] species occur at high burn severity sites starting several years post-fire . . . and these include the majority of ground and shrub nesters as well as many cavity nesters. Secondary cavity nesters, such as swallows, bluebirds, and wrens, are particularly associated with severe burns, but only after nest cavities have been created, presumably by the pioneering cavity-excavating species such as the Black-backed Woodpecker. Consequently, fires that create preferred conditions for Black-backed Woodpeckers in the early post-fire years will likely result in increased nesting sites for secondary cavity nesters in successive years.*[12]

Current science also recognizes that complex early-seral forests are highly diverse — similar, in fact, to the high structural diversity cherished in old-growth forests .[13] A recent study in the Sierra region found that total bird abundance in 8-year-old post-fire habitat that had not been salvage logged or artificially replanted was higher than in mature unburned forest.[14] The study noted that "areas burned by wildfire, especially those with older high severity patches, may in some cases support equal or greater land bird

Species That Benefit from Wildfires:

Black-backed woodpecker

Pallid bat

Mule deer

diversity and total bird abundance [than unburned forest].[15]"

This has been found in the wake of many fires, including the Donner fire of 1960, the Manter and Storrie fires of 2000, the McNally fire of 2002, and the Moonlight fire of 2007.[16] Wildlife abundance in CESF increases up to about 25 or 30 years after fire, and then declines as snag forest is replaced by a new stand of forest (increasing again, several decades later, after the new stand becomes old forest). Woodpeckers, like the black-backed woodpecker, thrive for 7 to 10 years after fire generally, and then must move on to find a new fire, as their beetle larvae prey begins to dwindle. Flycatchers and other birds increase for three decades after a fire. As CESF habitat is ephemeral, native biodiversity in the Sierra Nevada depends upon a constantly replenished supply of mixed-intensity fire.

Not only does CESF provide critical wildlife habitat, complex early seral ecosystems can result in a forest that is naturally more resilient to climate change :

> Naturally regenerated ESFEs [early seral forest ecosystems] are likely to be better adapted to the present-day climate and may be more adaptable to future climate change. The diverse geno-types in naturally regenerated ESFEs are likely to provide greater resilience to environmental stresses than nursery- grown, planted trees of the same species.[17]

Salvage logging, on the other hand, often results in a loss of resilience.[18] Such logging can also allow former forested areas to become dominated by invasive nonnative species, such as cheatgrass, which have little value to wildlife and increase the intensity of otherwise cool-burning ground fires.[19] This is especially so when herbicides are used as part of post-fire logging or replanting operations to reduce competition from early-successional plants, especially shrubs.

The Forest Service's Proposal to Log the Rim Fire Area Undermines Its Own Science

Research shows that species such as the black-backed woodpecker are highly vulnerable to even partial salvage logging.[20] Even the Forest Service's recently issued report "A Conservation Strategy for the Black-backed Woodpecker in California," documents the importance of complex early seral forest and recommends that Forest Service managers largely refrain from salvage logging in high-quality black-backed woodpecker habitat because the high snag densities that woodpeckers depend upon are not maintained in a logged-over forest.[21]

Salvage logging is not just about woodpeckers, however. By destroying the complexity that exists in CESFs, salvage logging eliminates much of the ecological value of this habitat, thus preventing the many other species that follow the beetles and woodpeckers from using the area. In a 2008 book on post-fire logging, forest ecologists explained:

> The notion that salvage logging assists the ecological recovery of naturally disturbed forests is fundamentally incorrect (Lindenmayer et al. 2004). Hence, justifications for salvage logging based on contributions to ecological recovery have little merit. We know of few circumstances where salvage logging has been demonstrated to directly contribute to recovery of ecological processes or biodiversity.

Lazuli bunting

California spotted owl

Pacific fisher

Northern goshawk

> [T]here is abundant theoretical and empirical evidence…that salvage logging interferes with natural ecological recovery..."[22]

Similarly, an avian scientist noted that "[t]he ecological cost of salvage logging speaks for itself, and the message is powerful. I am hard pressed to find any other example in wildlife biology where the effect of a particular land-use activity is as close to 100% negative as the typical postfire salvage-logging operation tends to be."[23]

In a recent letter to Congress, more than 200 scientists explained why Rim fire salvage logging should not be allowed:

> Numerous studies . . . document the cumulative impacts of post-fire logging on natural ecosystems, including the elimination of bird species that are most dependent on such conditions, compaction of soils, elimination of biological legacies (snags and downed logs) that are essential in supporting new forest growth, spread of invasive species, accumulation of logging slash that can add to future fire risks, increased mortality of conifer seedlings and other important re-establishing vegetation (from logs dragged uphill in logging operations), and increased chronic sedimentation in streams due to the extensive road network and runoff from logging operations.[24]
>
> We urge you to consider what the science is telling us: that post-fire habitats created by fire, including patches of severe fire, are ecological treasures rather than ecological catastrophes, and that post-fire logging does far more harm than good to the nation's public lands.

Recommendations for Maintaining Post-fire Ecological Integrity and Biological Diversity in the Rim Fire Area

Scientists have found that post-fire logging is inappropriate from an ecological perspective.[25] The Forest Service's forest-planning rule of 2012 directs the agency to maintain or improve ecological integrity, defined as "the quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence."[26] We recommend the following to meet that obligation:

1. **Post-fire logging should only be initiated to address legitimate public-safety issues.**

Because dead trees adjacent to frequently used areas such as campgrounds and well-traveled roads might fall on people, it can be necessary to fell some of those trees. However, to the greatest extent practicable, such tree-felling should also be done in a way that will reduce harm to wildlife, such as avoiding nesting seasons. In addition, once felled, these "hazard" trees no longer pose a safety risk, and should be retained in the forest as downed logs to provide habitat for wildlife.

Mountain bluebird

Western wood-pewee

Green-tailed towhee

Fox sparrow

"… the Forest Service salvage logging plans would cause real and tangible harm to the ecologically important habitats created by the fire as well as the future biological diversity of the region."

2. **Especially in light of its rarity, newly created complex early seral forest habitat should be protected. Post-fire logging should be avoided due to the ecological damage it will cause to wildlife and water.**

Based on the Forest Service's proposals for the Rim fire on the Stanislaus National Forest, post-fire logging could take place on the majority of the complex early seral forests. Logging, including the use of ground-based mechanized equipment, construction of graded landings and rebuilding the extensive road network, would cause additional damage to the landscape. This outcome would be contrary to the research and "conservation strategy" for the black-backed woodpecker, as well as contrary to the findings of much other wildlife research conducted in the Sierras.[27]

Post-fire logging targets the larger trees in complex early seral forests because those are the most commercially valuable trees. In addition to direct wildlife impacts, post-fire logging causes substantial damage to the soil and to aquatic areas. Logging operations — especially when they use ground-based machinery — compact the soil, remove important organic material, and increase the amount and duration of topsoil erosion and runoff.[28] Logging equipment can also crush newly naturally regenerating seedlings, significantly impeding the natural recovery process. Moreover, the use of herbicides as part of post-fire operations to prevent the growth of native early successional plants facilitates the spread of nonnative cheatgrass, which is a highly combustible fine fuel.

3. **Research funds should be dedicated to learning more about the biological diversity of post-fire areas.**

Additional research can further ensure that federal and state agencies best protect CESF habitat and will aid in the development of conservation strategies. For example, last year the Institute for Bird Populations and the Forest Service issued "A Conservation Strategy for the Black-backed Woodpecker (*Picoides arcticus*) in California." Such documents are needed for many other species as well.

Conclusion

The Rim fire was not ecologically damaging, but rather biologically restorative. Without fire, including high-intensity fire, the biological diversity of the Sierras would not exist as we know it. In contrast to the Rim fire, the Forest Service salvage logging plans would cause real and tangible harm to the ecologically important habitats created by the fire as well as the future biological diversity of the region.

Early-successional Post-fire Plants.

Green-leaf manzanita
Arctostaphylos patula

Whitehorn
Ceanothus cordulatus

White-leaf manzanita
Arctostaphylos manzanita

Endnotes

[1] See, e.g., "Rim Fire Leaves Sierra Moonscape For The Ages," at capradio.org; see also AP articles wherein Forest Service personnel describe the Rim Fire as a "moonscape" and "nuked." (http://bigstory.ap.org/content/tracie-cone).

[2] See, e.g., Stephens, S.L., R.E. Martin, and N.E. Clinton. 2007. Prehistoric fire area and emissions from California's forests, woodlands, shrublands and grasslands. Forest Ecology and Management 251: 205-216.

[3] See, e.g., Odion, D.C., and Hanson, C.T. 2013. Projecting impacts of fire management on a biodiversity indicator in the Sierra Nevada and Cascades, USA: the Black-backed Woodpecker. The Open Forest Science Journal 6: 14-23; Siegel, R.B., M.W. Tingley, R.L. Wilkerson, M.L. Bond, and C.A. Howell. 2013. Assessing home range size and habitat needs of Black-backed Woodpeckers in California: Report for the 2011 and 2012 field seasons. Institute for Bird Populations; DellaSala, D.A., M.L. Bond, C.T. Hanson, R.L. Hutto, and D.C. Odion. 2013. Complex early seral forests of the Sierra Nevada: what are they and how can they be managed for ecological integrity? Natural Areas Journal (in press).

[4] See, e.g., Odion, D.C. and D.A. Sarr. 2007. Managing disturbance regimes to maintain biodiversity in forested ecosystems of the Pacific Northwest. Forest Ecology and Management 246: 57-65.

[5] See, e.g., Odion, Dennis C., Max A. Moritz, and Dominick A. DellaSala. 2010. Alternative community states maintained by fire in the Klamath Mountains, USA. Journal of Ecology 98: 96-105; Keeley, J. E. 2000. Chaparral. In: Barbour, M.G.; Billings, W.D., eds. North American terrestrial vegetation, 2nd edition. Cambridge, UK: Cambridge University Press: 203-253.

[6] For the Rim Fire area, we defined "complex early seral forest" as conifer forest areas that: i) pre-fire, were identified as being in CWHR structural categories 4M, 4D, 5M, 5D, or 6, and ii) post-fire, were identified as having 50% basal area mortality or greater (RdNBR 477 and above). CWHR is a system for classifying vegetation; for example, an area listed as 5M means that it contains: i) medium/large trees (greater than 24 inches diameter at breast height), and ii) 40-59% canopy closure. http://frap.cdf.ca.gov/projects/frap_veg/classification.html.

[7] See Map 2, showing that the areas proposed for salvage logging overlap the majority of the complex early seral forest.

[8] See, e.g., Siegel, R.B., M.W. Tingley, R.L. Wilkerson, M.L. Bond, and C.A. Howell. 2013. Assessing home range size and habitat needs of Black-backed Woodpeckers in California: Report for the 2011 and 2012 field seasons. Institute for Bird Populations. A Forest Service video about the black-backed woodpecker research can be viewed at: http://www.fs.usda.gov/detail/r5/news-events/audiovisual/?cid=stelprdb5431394.

[9] 78 Fed.Reg. 21086. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to List Two Populations of Black-Backed Woodpecker as Endangered or Threatened (April 9, 2013).

[10] See, e.g., Bond, M. L., D. E. Lee, R. B. Siegel, and J. P. Ward, Jr. 2009. Habitat use and selection by California Spotted Owls in a postfire landscape. Journal of Wildlife Management 73: 1116-1124; Buchalski, M.R., J.B. Fontaine, P.A. Heady III, J.P. Hayes, and W.F. Frick. 2013. Bat response to differing fire severity in mixed-conifer forest, California, USA. PLOS ONE 8: e57884; Burnett, R.D., P. Taillie, and N. Seavy. 2010. Plumas Lassen Study 2009 Annual Report. U.S. Forest Service, Pacific Southwest Region, Vallejo, CA; Burnett, R.D., P. Taillie, and N. Seavy. 2011. Plumas Lassen Study 2010 Annual Report. U.S. Forest Service, Pacific Southwest Region, Vallejo, CA; Burnett, R.D., M. Preston, and N. Seavy. 2012. Plumas Lassen Study 2011 Annual Report. U.S. Forest Service, Pacific Southwest Region, Vallejo, CA; DellaSala, D.A., M.L. Bond, C.T. Hanson, R.L. Hutto, and D.C. Odion. 2013. Complex early seral forests of the Sierra Nevada: what are they and how can they be managed for ecological integrity? Natural Areas Journal (in press).

[11] See, e.g., Hanson, C.T. 2013. Pacific fisher habitat use of a heterogeneous post-fire and unburned landscape in the southern Sierra Nevada, California, USA. The Open Forest Science Journal 6: 24-30.

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[13] Donato, D.C., J. L. Campbell, and J. F. Franklin. 2012. Multiple successional pathways and precocity in forest development: can some forests be born complex? Journal of Vegetation Science 23: 576–584.

[14] Burnett, R.D., P. Taillie, and N. Seavy. 2010. Plumas Lassen Study 2009 Annual Report. U.S. Forest Service, Pacific Southwest Region, Vallejo, CA.

[15] Id.

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[26] 36 CFR 219.19.
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