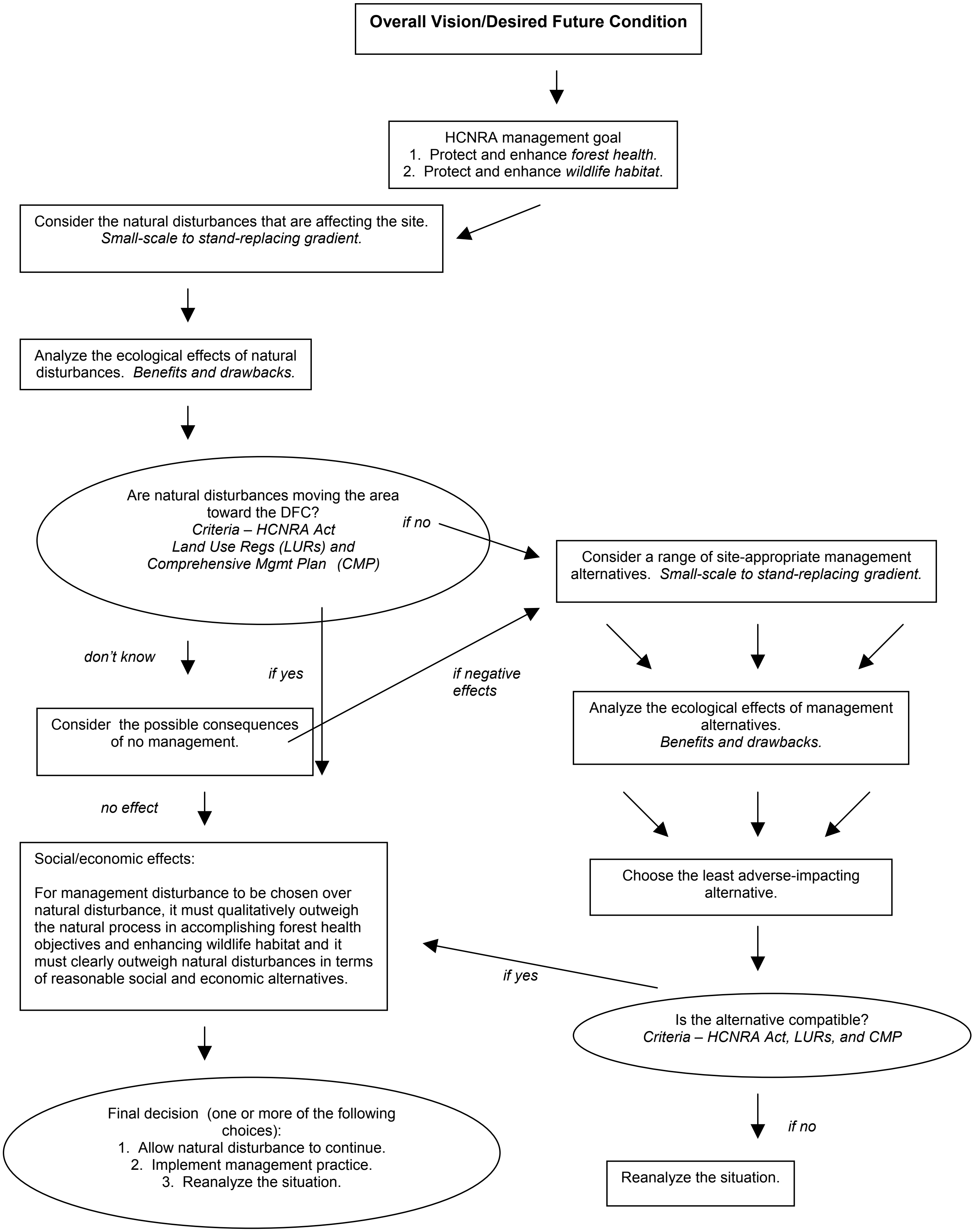
Forest Health Compatibility and Decision-Making in Hells Canyon NRA



Silviculture vs. Nature

Executive Summary

Hells Canyon National Recreation Area (HCNRA) was created in 1975 to protect and preserve the unique ecology and character of the deepest river canyon in North America. This canyon provides a vital east/west ecological linkage between the Eastern Cascades and the Northern Rockies. It is also a vital ecological linkage between different northern and southern vegetational zones, as many species are represented within the canyon which are only found much farther north or south. The forests of Hells Canyon, therefore, are a crucial ecological resource for this region of the country, and their biological uniqueness is legislatively protected by the HCNRA Act. Nevertheless, as currently managed by the Forest Service (as part of the Wallowa-Whitman National Forest) logging continues to threaten these resources, most specifically in the name of forest health and wildlife management.

Focusing on the Intermountain West in general and HCNRA in particular, this paper attempts to adopt an ecological rather than an economic definition of forest health by examining several forest health definitions that are commonly used by policy-makers. Once an ecological definition of forest health is accepted, natural disturbances and silvicultural practices can be analyzed for their ecological effects. Many “forest health” definitions as they appear in politics, the timber industry, the Forest Service and also the press focus almost singularly on tree mortality through natural disturbances. According to definitions such as these, as tree mortality increases, forest health decreases. For example, according to University of Idaho Forestry Professor Jay O’Laughlin (1994 p1):

> If forest health is about trees at risk of mortality from insects, diseases, and wildfires, then large areas of Idaho’s forests are in poor health, especially in the national forests that represent two-thirds of the state’s timberlands.

In addition, definitions that focus on tree health typically incorporate human needs into the definition of forest health. Incorporating human needs into a scientifically-based definition, biases the science, so that it can no longer be used as a basis for effective decision-making. The incorporation of human needs should occur at the decision-making level, not before it

University of Arizona forestry professors Kolb, Wagner and Covington (1994 p12) define a healthy forest ecosystem as one with the following characteristics:

- the physical environment, biotic resources, and trophic networks to support productive forests during at least some seral stages;
- resistance to catastrophic change and/or the ability to recover from catastrophic change at the landscape level;
- a functional equilibrium between supply and demand of essential resources (water, nutrients, light, growing space) for major portions of the vegetation; and
- a diversity of seral stages and stand structures that provide habitat for many native species and all essential ecosystem processes.

and see if natural disturbances will take the forest there. (The information presented in the tables is applied on a site-specific basis to determine the effects.) If the natural disturbances are moving the site toward the DFC, then consider the social and economic effects before making a final decision to allow the process to continue. For example, if the site is at an urban/wildland interface, it may be best to use some type of management to reduce fuel loading and lower the risks of stand-replacing fire.

In some instances, however, it may be difficult to determine whether or not the conditions are lending to the DFC. In these cases it is necessary to consider the possible consequences of allowing the natural processes to continue with no management. For instance, past human activities such as logging, mining, and road building may have degraded terrestrial or aquatic conditions to such a point that further natural disturbances will reduce quality habitat availability below a critical threshold for sensitive, threatened, or endangered species. In these cases, the cumulative impacts to the environment require restorative action. If negative effects are determined, then it is time to move to the right hand side of the flow chart and consider a site-appropriate range of alternatives.

Management alternatives are not limited to silviculture alone. When considering the range of alternatives, options such s road closures, prescribed fire and removing livestock should be considered before silviculture. These are the least adverse-impacting alternatives. If habitat fragmentation has impacted population viability for a certain species, it will probably be better to obliterate and revegetate roads than to apply silvicultural practices to alter and further impact the remaining habitat.

The ecological benefits and drawbacks of the different management alternatives are now considered, and then the least adverse-impacting alternative is chosen. If this fits in with the legal mandates that govern the area, then social and economic effects are considered. If it does not fit with the legal regulations, then the situation must be completely reanalyzed. The management disturbance must qualitatively outweigh the natural process in accomplishing forest health objectives, or it must completely outweigh the natural process in terms of reasonable social and economic alternatives. An economic analysis should consider the long-term economic implications of the chosen alternative, and this analysis should incorporate all ecological costs.

Although the information provided within this summary focuses specifically on timber sales, equivalent information can be gathered to determine the compatibility of grazing allotments, mining, recreational activities, etc. It is a tool to help the Forest Service comply with their own regulations regarding public lands management. As forest managers attempt to understand how to work more harmoniously with natural systems, they often are driven by political and economic desires to utilize practices that may not accomplish their ecological goals. Therefore, it is up to activists to utilize this tool to bring into the public light the backward, and often clear political and economic motivation behind ”forest health” management proposals on public lands.

Table 1

Ecological Effects of Natural Disturbances: Insects*

Ecological Benefits	Ecological Drawbacks
Increase tree vigor & stand productivity: 1) long-term vigor increases in trees that survive defoliation (19,29,46,78) 2) tree mortality reduces competition and increases vigor in residual trees - reduces susceptibility to pests (19,29,45,46,49,57,78,79) 3) defoliators can increase tree survivability in droughts by reducing water loss transpiration (45,79) 4) increases nutrient cycling, soil function, and stability (19,29,46,47) 5) down woody material increases soil moisture retention (29,44,78)	Decreases tree vigor & stand productivity: 1) large amounts of standing, dead trees increase risks of stand-replacing fire (epidemic) 2) increases susceptibility to additional endemic and epidemic disturbances (19)
Increase stand complexity: 6) in concert with disease and fire, insects help maintain the shifting mosaic of small even-aged patches within a larger uneven-aged landscape - this reduces the likelihood of epidemic disturbances (19,29,73,78,80) 7) long-term structural changes allow natural fire to regain its role as an ecosystem regulator	
Increases wildlife habitat: 8) increases wildlife snags (benefits cavity nesting birds and mammals), increases coarse woody material to the forest floor (benefits small mammals, invertebrates), and increases large woody debris to streams (improves stream structure, number of pools, spawning habitat) (29,44,88) 9) changes in stand structure can increase browsing habitat for ungulates (epidemic) (19,78,89) 10) increases in snags lead to increases in insectivorous bird populations which help maintain endemic levels of insects (endemic) (60,89) 11) snow retention in created openings can increase peak flows and improve streambed scouring (19)	Decreases wildlife habitat: 3) jack-strawed dead trees can impede movement of megafauna (19) 4) epidemics can lead to high tree mortality which reduces thermal and hiding cover for ungulates (epidemic) (89) 5) increases in peak stream flows cause problem for unstable streambanks (epidemic) (19) 6) reduced streamside shading increases water temperatures – can stress or kill fish (epidemic) (74,82)

* Defoliators and beetles are the two types of insects which have the above effects on intermountain western forests. Unless otherwise specified, the effects occur through both epidemic and endemic levels of insects. (The numbers refer to citations from the reference list.)

Table 2

Ecological Effects of Natural Disturbances:
Diseases*

Ecological Benefits	Ecological Drawbacks
Increases tree vigor & stand productivity: 1) excellent nutrient cycling increases soil function and stability (root/stem) (58) 2) tree mortality reduces competition and increases vigor in residual trees – reduces susceptibility to pests (root/stem) (19,29,45,46,49,57,78,79) 3) down woody material increases soil moisture retention (29,44,78)	Decreases tree vigor & stand productivity: 1) trees can live with many different diseases for long periods of time, but vigor is reduced, susceptibility to insects is increased (21,81) 2) trees infected with root pathogens have increased susceptibility to windthrow (19)
Increases stand complexity: 4) changes in stand structure reduce likelihood of future epidemic disturbances (root/stem) (78,79,80) 5) in concert with insects and fire, diseases help maintain the shifting mosaic of small even-aged patches within a larger uneven-aged landscape (19,22,29,73,78,80) 6) small openings created by disease centers provide sunlight for shade-intolerant tree regeneration 7) stands move toward dominance by species tolerant of the on-site pathogens (root/stem) (21,22,58) 8) long-term structural changes allow natural fire to regain its role as an ecosystem regulator (19)	Decreases stand complexity: 3) dwarf mistletoe increases fuel loading at the individual tree scale, especially if brooms are close to the ground (29) 4) small and large scale fuel loading can increase, especially if trees fall down in a jack-strawed pattern

Table 3

Ecological Effects of Natural Disturbances:
Understory Fire*

Ecological Benefits	Ecological Drawbacks
Increases tree vigor & stand productivity: 1) stimulates ponderosa pine growth (23,52) 2) improves overall vigor and resistance to pests (34,52) 3) increases biodiversity (52) 4) stimulates cone crops (52) 5) reduces invasions by exotics (52) 6) fire sterilizes sites from certain pathogens and kills insects (2) 7) smoke inhibits certain pathogens (2,19) 8) increases nutrient availability (34)	Decreases tree vigor & stand productivity: 1) ladder fuels and thick litter layers in areas where fire has been suppressed can cause old growth mortality or stand-replacing fires on sites formerly dominated by understory burns (52) 2) wounds create openings for insects and pathogens (76)
Increases stand complexity: 9) re-establishes a more natural vegetative species mix (52) 10) maintains an open parklike structure within the stand, thus maintaining conditions which dampen epidemic disturbance levels and maintain endemic levels (2,78) 11) promotes the regeneration of shade-intolerant species (78)	Decreases stand complexity: 3) promotes monocultures, which are generally more susceptible to stochastic events (54)
Increases wildlife habitat: 12) increases forage (1,52) 13) adds snags and down woody material for small mammals and cavity nesting birds (88) 14) increases snow accumulation, earlier spring melting, changes peak flows (88)	Decreases wildlife habitat: 4) repeated understory fires consume down woody material quickly (1) 5) understory fires can maintain an open enough canopy that hiding and thermal cover are reduced (1)

* Understory fires are most appropriate on low-elevation dry or moist to dry sites. These sites may be more common on south-facing slopes as well. Understory burning is most likely on sites which still contain seral species in the overstory. Understory mean fire return interval is typically between 5-20 years. (The numbers refer to citations from the reference list.)

Table 4

Ecological Effects of Natural Disturbances: Stand-replacing Fire*

Ecological Benefits	Ecological Drawbacks
Increases tree vigor & stand productivity: 1) can improve long-term nutrient conditions, especially when site is recolonized by nitrogen-fixers 2) ends insect outbreaks (19) 3) promotes regeneration of serotinous species (1)	Decreases tree vigor & stand productivity: 1) nutrient leaching and volatilization of soil chemicals (1) 2) soil erosion and hydrophobic soils both limit regeneration and stand productivity 3) reduced vigor in surviving trees – increased susceptibility to insects and disease (57) 4) increased susceptibility to windthrow along newly created edges (1) 5) smoke may increase atmospheric carbon and contribute to global warming – affecting future climate and therefore stand conditions (1)
Increases stand complexity: 4) standing snags and surviving trees ameliorate site conditions enough to improve post-fire regeneration by providing summer shade and winter thermal cover (64) 5) creates a mosaic of stand conditions throughout the landscape – this breaks up habitat continuity and reduces potential stand-replacing insect/disease events (2) 6) stand-replacing fires restart forest succession (78)	Decreases stand complexity: 6) on sites where lodgepole was present, lodgepole monocultures may develop and begin the lodgepole, insect, fire cycle (this is not necessarily a drawback) (2) 7) snags and downed trees provide fuels for a reburn which may convert the stand to shrub vegetation for a long period of time (2)
Increases wildlife habitat: 7) increases availability of wildlife snags 8) creates uniquely necessary conditions for fire-dependent species like the black-backed woodpecker (30) 9) long-term habitat stability is improved through diverse landscape structures and habitat conditions (2,78) 10) increases forage for ungulates (1,52) 11) inputs coarse woody material into streams and onto the forest floor	Decreases wildlife habitat: 8) short term loss of habitat, including thermal and hiding cover (1) 9) increases in sedimentation through erosion and hydrophobic soils can reduce spawning habitat (1,2) 10) loss of streamside shading can lead to increased stream temperatures

*Stand-replacing fires are common in higher elevation, cooler and moister sites – often on north-facing slopes. They typically leave some vegetation unburned, creating a mosaic of habitat types within the landscape. Fire return intervals vary from 50 to 300 years. (Numbers refer to reference list.)

Table 5

Ecological Effects of Anthropogenic Disturbances: Overstory Thinning*

Ecological Benefits	Ecological Drawbacks
Increases tree vigor & stand productivity: 1) reduces competition for nutrients, sunlight and water	Decreases tree vigor & stand productivity: 1) soil compaction reduces soil fertility and spread root disease (19,64,78,105) 2) root disease infects untreated stumps, spreading disease to residual trees (15,78) 3) increases change of windthrow (19,57) 4) residual tree wounding increases susceptibility to insects and disease (15,19,78,105) 5) introduction of exotic species reduces biodiversity (28,53,60) 6) slash burning fires can escape into wildfires (64) 7) reduces nutrient cycling by removing biomass (57)
Increases stand complexity: 2) may release understory 3) can recreate desired stand conditions (2)	Decreases stand complexity: 8) does not reduce spread of insects, disease or fire 9) favors shade tolerant species and even-aged mgmt. 10) does not favor fire reintroduction 11) does not mimic natural processes or restore natural patterns (2) 12) reduces old growth structure and function
Increases wildlife habitat: 4) increased sunlight stimulates forage production (19,89) 5) blowdown increases habitat associated with down woody material (88)	Decreases wildlife habitat: 13) reduces wildlife snags 14) reduces interior habitat (28,57,64) 15) fewer coarse woody material inputs to streams 16) reduces streamside shading 17) road building increases sedimentation, fragments wildlife habitat and creates access for hunters

*Overstory thinning is suitable on sites with a vigorous understory and no root disease. But, sites like this are already "healthy," so overstory thinning will not actually improve conditions. It is not suitable on sites without a clearly dominant overstory. (The numbers refer to citations from the reference list.)

Table 6

Ecological Effects of Anthropogenic Disturbances:
Understory Thinning*

Ecological Benefits	Ecological Drawbacks
Increases tree vigor & stand productivity: 1) increases vigor through reduced competition for nutrients, sunlight, and water (19,29,57)	Decreases tree vigor & stand productivity: 1) soil compaction through repeated entries and heavy machinery reduces soil fertility and productivity, spreads root disease to susceptible species (19,64,76,105) 2) root disease infects untreated stumps and spreads to residual trees (15,76) 3) residual tree wounding increases susceptibility to insects and disease (15,19,76,105) 4) introduction of exotic species reduces biodiversity (28,53,60) 5) removing biomass reduces nutrient cycling (58) 6) reduced down woody material reduces soil moisture retention 7) does not mimic the beneficial effects of smoke and fire in reducing insect and disease events
Increases stand complexity: 2) host-species removal reduces insect or disease problems (49) 3) understory thinning moves stands toward more seral structures, or towards old growth structure, this restores endemic levels of disturbances, and reduces susceptibility to stand-replacing events (57,101) 4) restores open parklike structure, allowing reintroduction of understory fire 5) reduces fuel loading 6) increases structural diversity	Decreases stand complexity: 8) requires repeated entries to maintain open structure in lieu of fire reintroduction 9) favors natural regeneration of shade-tolerant tree species unless some openings are wide enough for intolerant regeneration

Table 7

Ecological Effects of Anthropogenic Disturbances: Group Selection*

Ecological Benefits	Ecological Drawbacks
Increases tree vigor & stand productivity: 1) small openings create varied microclimatic conditions which allow regeneration of all different species (83) 2) the surrounding trees aid natural regeneration (83)	Decreases tree vigor & stand productivity: 1) if the size of the cut is too large, it effectively creates a clearcut (12,83,87) 2) reduces windfirmness in edge trees (60) 3) soil compaction reduces soil fertility and productivity (19,64,76,101) 4) reduces nutrient cycling as biomass is removed (58) 5) introduction of exotic species reduces biodiversity (28,53,60)
Increases stand complexity: 3) over long term – mimics shifting mosaics of even-aged stands within an uneven-aged landscape mosaic (83) 4) over long term – reduces habitat continuity, eventually increasing resistance to insect and disease epidemics 5) allows regeneration of shade-intolerant species (83) 6) over long term – allows reintroduction of understory fire	Decreases stand complexity: 6) requires continued fire suppression in the short term 7) offers little short-term relief from insect or disease disturbances 8) increases in edge effect reduces interior stand conditions (57,60) 9) patchy openings can experience severe temperature fluctuations which inhibits regeneration and increases susceptibility of residual trees to insects/diseases (57,83)
Increases wildlife habitat: 7) over long term – provides diverse wildlife habitats 8) increases forage production in openings 9) increases edge effect (57)	Decreases wildlife habitat: 10) edge effect reduces interior habitat and increases predatory access to interior prey species (28,57,64) 11) associated road building increases hunting access and fragments habitat (64)

* Group selection is suitable on sites which naturally experienced spot burns, root disease centers or other small openings. It is only suitable if the size of the group selection is limited to twice the height of the trees in the surrounding stand. Group selection is unsuitable if the size is too large and on sites with continuous stands of suppressed trees. (The numbers refer to citations from the reference list.)

Table 8

Ecological Effects of Anthropogenic Disturbances: Prescribed Fire*

Ecological Benefits	Ecological Drawbacks
Increases tree vigor stand productivity: 1) reduced competition increases residual tree vigor (34,52) 2) increases nutrient availability in the soil (19,23,34) 3) underburning increases vigor in ponderosa pine stands by changing soil chemical characteristics (23) 4) smoke from fires may inhibit insect and disease abundance (2,19)	Decreases tree vigor & stand productivity: 1) fire scarring provides openings for insects and disease – reduces vigor in scarred trees (19,76) 2) spring burning causes following problems (1) * flushing buds are susceptible to damage; * shrub carbohydrate reserves in the roots (for regeneration) are at a yearly low; * can weaken and kill sprouting shrubs; * can kill seeds of native herbaceous perennials (in moist soils); * can kill fine confier roots which may predispose trees to moisture stress during the dry season. 3) fires may become stand-replacing (see drawbacks of stand-replacing fires)
Increases stand complexity: 5) a series of wet season underburns can reduce fuel loading and restore original stand structure (1,52) 6) may allow reintroduction of natural fire as ecosystem regulator (precluding the need for continued silvicultural management and fire suppression)	Decreases stand complexity: 4) promotes monocultures – monocultures are generally more susceptible to stochastic events (53)
Increase wildlife habitat: 7) increases diversity of wildlife habitat 8) increases forage (1,52) 9) increases in standing snags benefit cavity nesting birds and small mammals (88)	Decreases wildlife habitat: 5) spring burning can affect nesting and breeding conditions, fall burning can reduce animals' physical condition as they prepare for winter (98) 6) increases stream sedimentation

* Prescribed understory burning is suitable on dry and moist/dry sites which traditionally supported seral species and still have a seral component in the understory. It is unsuitable on sites not traditionally dominated by understory fire (e.g., cool, moist, higher elevation sites), when the weather is extremely dry and fire may go out of prescription, or near the urban/wildland interface. (The numbers refer to citations from the reference list.)

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