Fire and Forest Insect Pests

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Forest fires affect insect populations by killing individuals and modifying the environment in which they live. By the same token, insect populations affect the forests and frequently increase the fire hazard. For purposes of this paper, insects will refer to only those species usually considered forest pests. This consideration ignores the multitude of forest insects that do not directly affect human activities. Such species are, therefore, not subject to various suppression methods although they may be affected by them.

Fire is used to kill populations of insects inhabiting the bark or wood portion of trees but is rarely used to kill foliage insects. The branches, and cull logs created by logging activities, provide suitable habitat for some species of bark beetles—the most detrimental being in the genera *Ips* and *Dendroctonus*. The infestation of logging residuals in itself is not detrimental, but the populations developing within the logging residuals frequently infest living trees upon emergence if no additional residuals are available. In pine, *Ips-*infested slash is piled and burned to kill the brood. In spruce, logging residuals—mostly cull logs—are also piled and burned to suppress spruce beetle populations. Because the bark beetle brood develops within the phloem of the bark, the entire woody portion of the branch or log does not have to be consumed, just seared or heated to the point of destroying the inner bark or killing the inhabiting brood. Burning beetle-inhabited logging residuals is useful in suppressing endemic populations but is impractical in suppressing populations during outbreaks.

Fire is also used to kill populations of insects in standing trees or as part of felling and burning techniques. Standing *Dendroctonus*-infested pine are cut, piled, and burned when small infested groups occur. This technique is used to suppress small, scattered infestations of beetles but is rarely used during extensive outbreaks.

Prescribed burning has seldom been used to kill insects, primarily because few species inhabit the ground surface during any part of their life cycle. Lepidopterous species (moths) are found in the litter more than any of the other major insect pests because various species pupate in the litter or upper few centimeters of soil. Prescribed burning has been used against one species—the pandora moth—with limited success. Early summer burns killed about 60% of the pupae. Mortality was limited by the sparse, interrupted distribution of the litter, which prevented the fire from killing pupae in the bare soil.

Early summer burns coincide with periods of high fire danger. Thus, their use may be restricted because of possible conflagrations arising from the prescribed burning. Fall burning is more satisfactory from the fire danger standpoint. However, the very conditions that reduce the fire danger—moister litter, cooler air temperatures—also inhibit the buildup of sufficient heat to cause pupal mortality. Fall burning is less successful than early summer burning.

If prescribed burning against the pandora moth is an indication of the success of the technique against other insects, then prescribed burning has limited use in suppressing ground-inhabiting forest insects. However, the success of prescribed burning may depend to a great extent on insect habits as well as litter accumulations. If the insect is like the pandora moth—pupating in essentially bare soil as well as in and beneath the litter—then a fire will cause less than acceptable mortality. If the insect pupates or overwinters solely in the litter—e.g., cone beetles—then fire may cause consistently higher mortality.

In contrast to insect suppression, prescribed burning may predispose trees to the attacks of bark beetles and wood-borers. In the Southwest, large ponderosa pines usually have a thick deposit of litter around the
trunk at ground level and this generates high temperatures during prescribed burning. If these trees are not killed outright, they can be severely damaged and then become infested by the western pine beetle, *Dendroctonus brevicomis* LeConte, and die. Prescribed burning of mature pine on forests such as the Kaibab National Forest may also just char the bark at the bases of the trees. These trees may be subsequently infested by the red turpentine beetle, *Dendroctonus valens* LeConte, which infests the lower portion of the bole. While red turpentine beetle attacks rarely kill the tree, they do dispose it to other bark beetles that may kill it. Also attracted to fire-scorched trees are wood-borers—roundheaded (cerambycid) and flatheaded (buprestid) beetles. These borers are abundant in trees damaged or killed by wildfires. They cause more damage than the red turpentine beetle because they bore into the woody tissue and may create extensive galleries within the wood, thus degrading the lumber.

Forest fires as well as the lack of them have frequently been cited as promoting stand conditions conducive to extensive infestations. Forest fires in the late nineteenth century created extensive, high-density, even-aged, lodgepole pine stands. These stands have now reached the size to be highly susceptible to the mountain pine beetle. Extensive infestations of the mountain pine beetle are now occurring in the northern Rockies. Similarly, the lack of widespread fires in the mixed conifer forest type has been cited as the reason for the development of high-density, uneven-aged, multistoried stands. Such stands, when composed mostly of Douglas-fir or Douglas-fir and white fir, are highly susceptible to outbreaks of the western spruce budworm and Douglas-fir tussock moth.

Forest fires generally influence insect populations but sometimes insect populations influence forest fires. Bark beetle-killed trees increase the short-term fire hazards. The dry needles and fine branches of recently killed trees increase the fine fuel component of fire danger. This danger remains high until the needles and twigs are lost from the dead trees—3 to 5 years after tree death. The larger branches and boles of dead trees increase the large fuel component for fires. As a result, any fire will be more severe. This increase in fuel loading will last for 10-20 years for pine and 30-50 years for spruce. Eventually the trees fall and become part of the ground-fuel component until they deteriorate.

**Selected Readings**


