APPENDIX I
Insects & Disease

Appendix I

Fire 2000 Assessment
INSECT & DISEASE
October 2000
Russ Gautreaux

As described in the discussion of historic vegetative conditions, the long-term health of ecosystems is linked to disturbance. Recurrence of disturbance and recovery within ecosystems is an important mechanism for energy flow, maintenance of habitat diversity, vegetative succession, canopy reduction, etc. In most sustainable forest ecosystems, insects and pathogens are the major nutrient recyclers and often are the most evident disturbance to us.

The Kootenai National Forest continues to experience tree mortality as a result of the Douglas-fir beetle outbreak which originated following the winter of 1996-1997. There is a concern that the wildfires of 2000 now provide an additional means for this infestation to continue as fire-stressed Douglas-fir stands become a potential food source. There is a need to begin the process of addressing fire effects and how both short- and long-term management decisions might be affected; and how insect and disease interactions with fire-damaged trees and stands could influence those decisions.

Several conditions must exist for bark beetles to take advantage of fire-damaged hosts (Gibson et al, 2000). First, there must be a sufficient supply of undamaged inner bark in the fire-affected trees. If the beetles' food supply, the inner bark (phloem), becomes dry and darkened—often the case in stand-replacing fires or in thin-barked tree species—beetles can neither feed nor deposit eggs in it. Second, the fires must occur at a time when beetles can take advantage of available food sources. Fires in late summer or early fall may occur after beetles have flown in a particular year. If not attacked while still usable, a tree's inner bark may dry sufficiently to be of no use to beetles by the next flight season. And third, there must be a population of beetles within a reasonable distance to take advantage of available weakened trees. Douglas-fir beetle, spruce beetle, and pine engraver beetle outbreaks following wildfires in 1988 and 1994 became extensive and quite damaging in parts of the Northern Region.

Following the 1988 Yellowstone National Park fires, Amman and Ryan (1991) concluded "The 1988 fires in the Greater Yellowstone Area killed many trees outright. Many more were subjected to sublethal injuries resulting in increased susceptibility to insect attack. Still other trees escaped fire injury but are exposed to the spread of insect attack from nearby injured trees." A follow-up report, by Rasmussen, et al (1996), showed in that same area "that bark beetle and delayed tree mortality due to fire injury significantly alter mosaics of green and fire-injured trees, that insect infestation increases with the percent of basal circumference killed by fire, and that bark beetle populations appear to increase in fire-injured trees and then infest uninjured trees."

Ryan and Reinhardt (1988) demonstrated that post-fire mortality can be predicted as a function of crown scorch and bark thickness for most western conifers. Their studies concluded that probability of mortality increased with percentage of crown killed and decreased as bark thickness increased. Weatherby, et al (1994) used those relationships in an effort to evaluate tree survivability following the Lowman (Idaho) fire of 1989. In their study area, 82% of the ponderosa pine and 52% of the Douglas-fir survived the fire; but a significant portion of the trees, which died, were killed by bark beetles as opposed to direct fire effects. In fact, they noted that many larger diameter trees predicted to survive the fire were subsequently killed by Douglas-fir beetles.

Observations made following wildfires in western Montana have shown that Douglas-fir, particularly, is likely to be killed by Douglas-fir beetles if about half of the bole circumference has been adversely affected by fire. Occasionally, that damage can be somewhat inconspicuous, if it occurs to large, lateral roots at or below the duff layer. Amman and Ryan (1991) showed 71% of the Douglas-fir on their Yellowstone plots died—over twice as many as predicted by the model using crown scorch and bark thickness characteristics. They surmised, "A possible explanation is that Douglas-fir tends to have large lateral roots near the soil surface that are often injured by fires. Thus, unmeasured root injury may have contributed to the higher than expected mortality. However, because several of the dead Douglas-firs received minimal heating, insects appear to be responsible for part of the additional mortality."

In stands where Douglas-fir is a major component, Fire Severity class 2 **is** likely to attract the most bark beetles. While thick-barked and potentially able to survive the immediate effects of the fire, bole scorch on more than half of the tree circumference will likely produce a strong attraction for Douglas-fir beetles (Gibson et al, 2000). In fire severity class 3 most Douglas-fir will survive and not attract beetles unless smoldering ground fires significantly damaged roots or root collars.