



Fir Engraver

Scolytus ventralis

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Hosts

- True fir:
 - Grand fir (*Abies grandis*)
 - White fir (*Abies concolor*)
 - Noble fir (*Abies procera*)
 - Red fir (*Abies magnifica*)
- Rarely:
 - Subalpine fir (*Abies lasiocarpa*)
 - Douglas-fir (*Pseudotsugae menziesii*)
 - Engelmann spruce (*Picea engelmannii*)
 - Mountain hemlock (*Tsuga heterophylla*)
 - Western larch (*Larix occidentalis*)

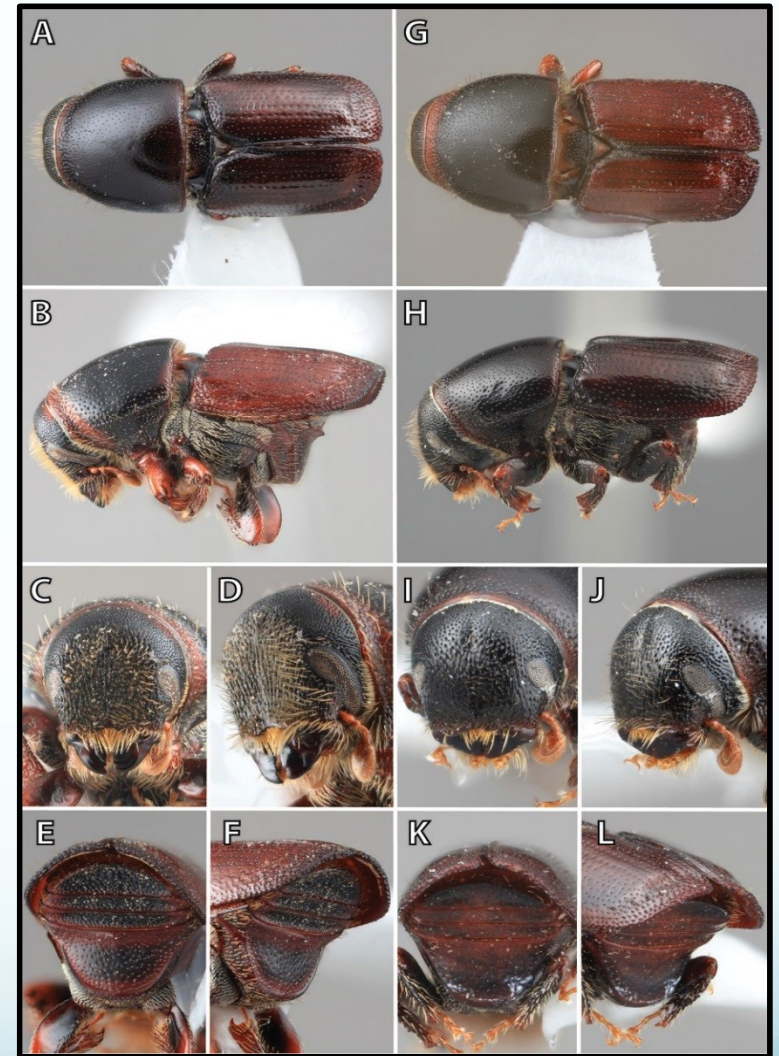


Identification

- 0.2 in (4 mm)
- Incurved abdomen (sawed off appearance)

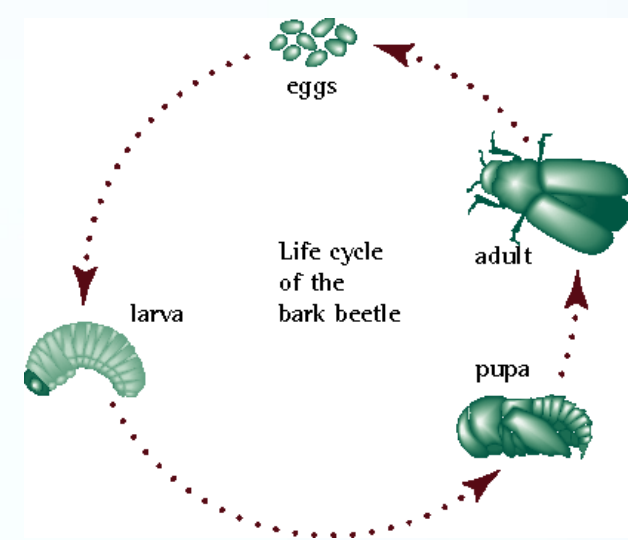
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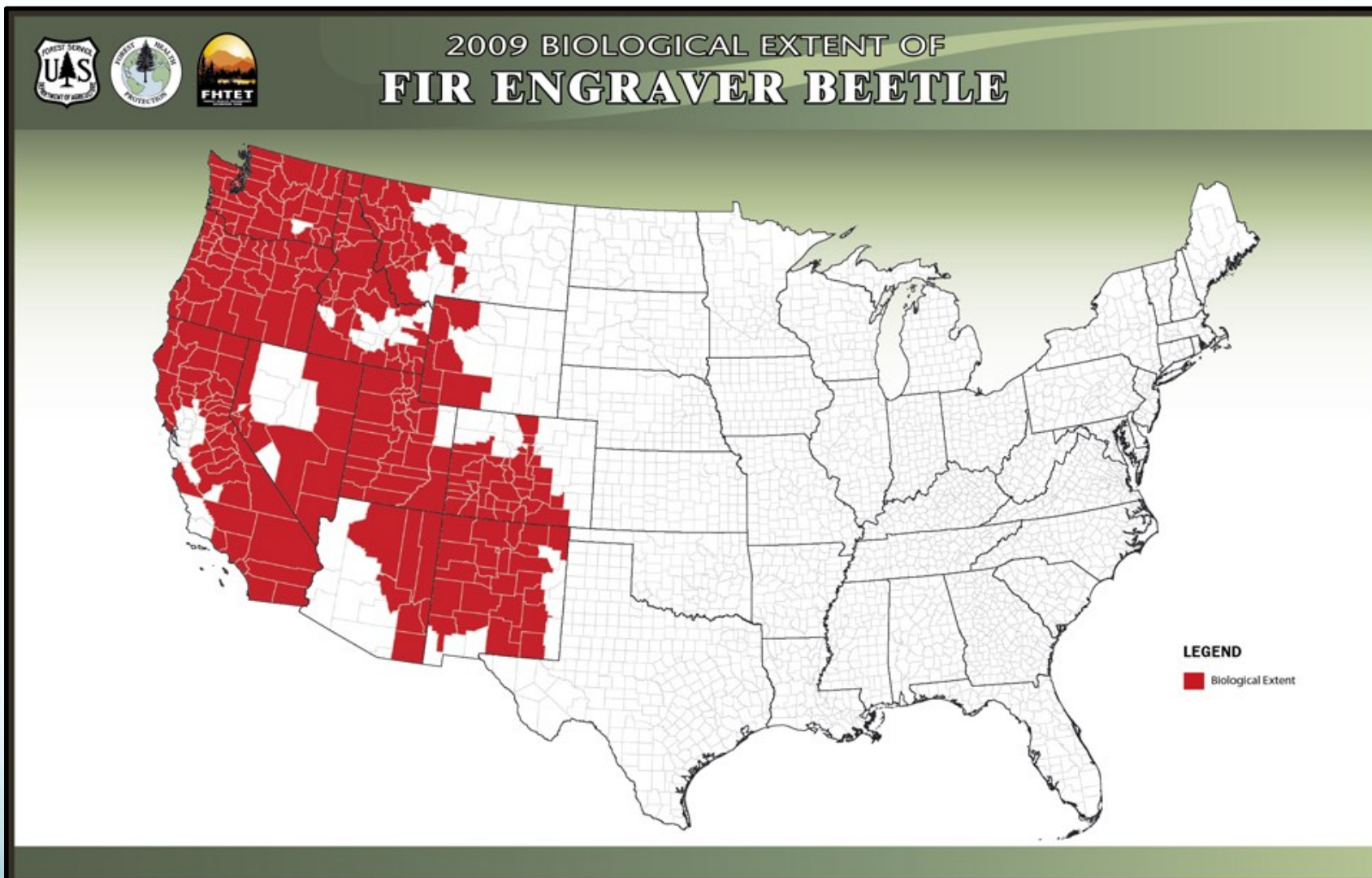


Identification: Life History

- One year lifecycle in OR and WA
 - Summer: Attack trees from June through September
 - Peak activity in mid-July
 - Female lays 100-300 eggs, hatch in about 2 weeks
 - Winter: Mostly larvae are present under the bark
 - Spring: Larvae feed for a short period before pupating
 - Pupation: 1 to 2 weeks
 - New adults remain in the tree for another 2 weeks before emerging



Distribution of Range



Damage

- Attack trees greater than 4" DBH
- No pitch tubes
- Clear pitch sometimes streams from the point of attack
 - Not frequently seen in intermountain West
- Red-brown boring dust in bark crevices of larger diameter trees along trunk
- Favor the branch collar area at the junction of a branch and the tree bole



Damage

- Galleries
 - Provide best diagnostic sign
 - Nuptial chamber
 - Egg galleries are horizontal to the ground and 4 to 12 inches long
 - Deeply score the sapwood
 - Smaller larval galleries run perpendicular to the egg gallery



Damage

- Silver fir beetle (*Pseudohylesinus sericeus*)
 - 0.09-0.15 in (2.4-3.9 mm)
- Does not have “sawed off” abdomen
- Horizontal egg gallery
 - Shorter (1-7”; avg. 2.6”)



egg galleries and vertical larval mines
wood attack by *Pseudohylesinus* species.



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Damage

- Whole tree mortality
 - Trees may be killed singly or in groups
- Colonized trees are difficult to detect
- Dying firs fade from yellow-green to orange, then a deep maroon red in 3-6 months after attack



Damage

- Frequently colonize trees without killing them
- Cause:
 - Topkill
 - Scattered dead branches
 - Dead patches of cambium (strip attacks)



Damage

- Strip attacks:
 - Roughened patches of bark where the cambium layer beneath has died
 - Healthy trees can recover and some trees are attacked in this way many times
 - Defects such as stain, ring-shake and decay are associated with old attack scars



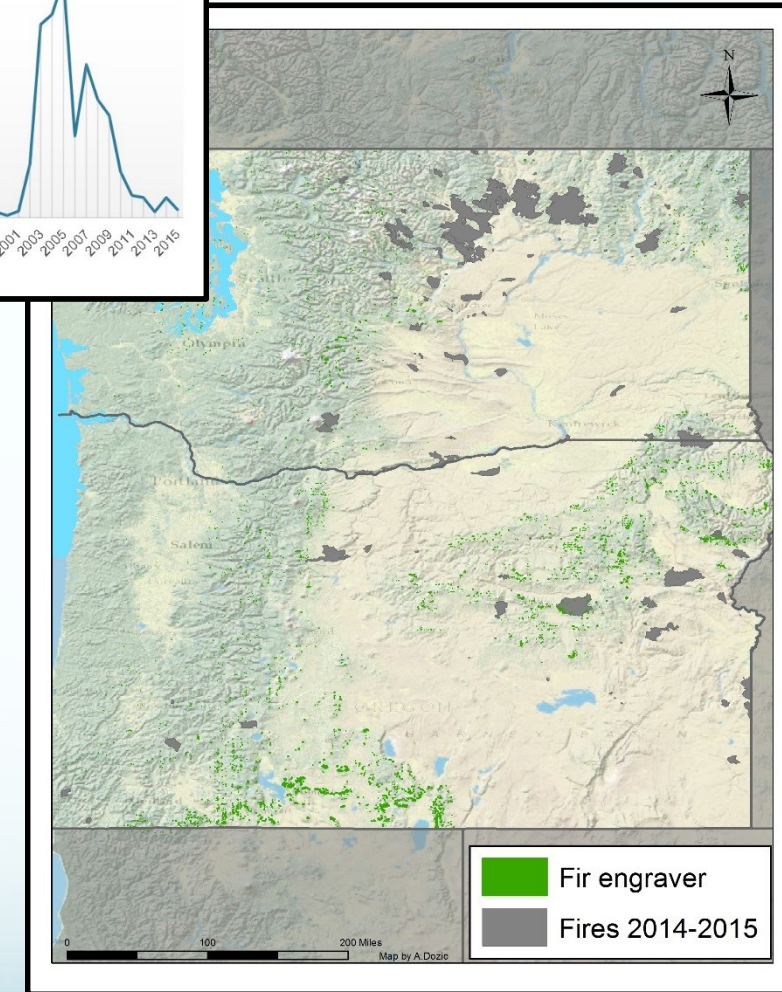
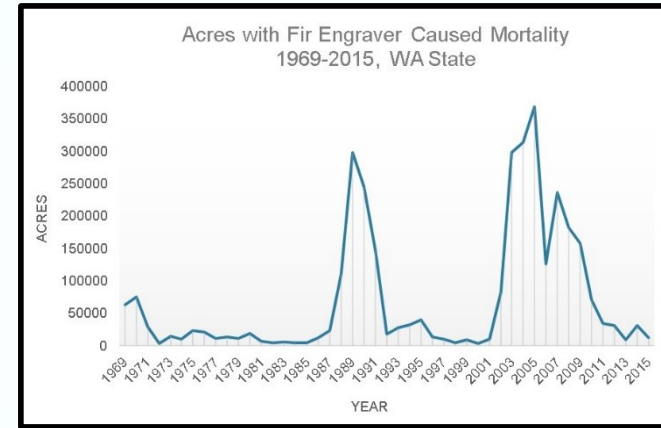
Damage

- Carry brown staining fungus, *Trichosporium symbioticum*, which discolors the sapwood surrounding the egg gallery to a yellowish-brown within 4 to 6 days



Severity

- Considered a major pest of true fir in western forests
- The most destructive conifer-feeding *Scolytus* species in the Nearctic
- Fir engraver may sometimes cause significant mortality over large areas
 - WA: 235,958 acres with mortality caused by fir engraver in 2007



Predisposing Agents

- Secondary pest, cannot successfully attack and kill healthy vigorous trees
- Predisposing agents:
 - Defective
 - Overmature
 - Injured
 - Dense stands
 - Strongly associated with root disease in WA and OR



Predisposing Agents

- Drought
 - Dry true fir sites that under natural fire regimes were occupied by pines experience the highest levels of mortality during periods of drought

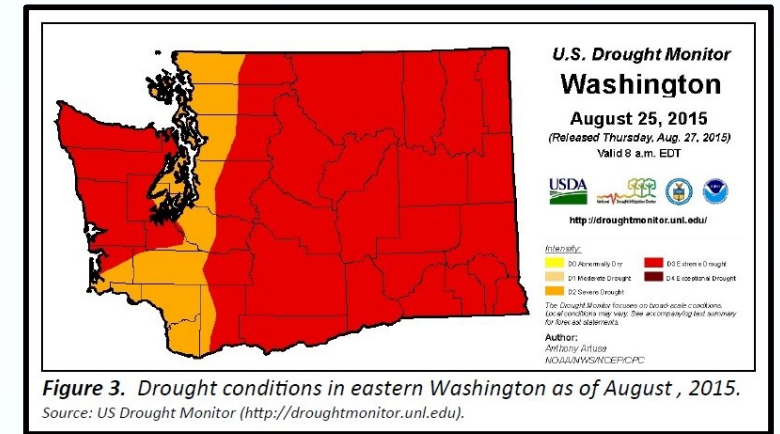


Figure 3. Drought conditions in eastern Washington as of August , 2015.
Source: US Drought Monitor (<http://droughtmonitor.unl.edu>).



White fir in PIPO understory
NAU: Ecological Restoration Institute



Predisposing Agents

- Defoliation
 - Western Spruce Budworm
 - Douglas-fir Tussock Moth
- Fir engraver activity in stands affected by defoliation typically reaches its highest level within 1 to 3 years following peak defoliation



Western spruce budworm defoliated grand fir, Oregon



Predisposing Agents

- Presence of fresh windthrow, slash, and lightning struck trees provide fir engravers with susceptible host material



Management: Natural Control

- Predators
 - Clerids (*Enoclerus lecontei*)
 - Long-legged Fly (*Medetera aldrichii*)
 - Braconid wasps
 - Woodpeckers
 - Nematode parasites
- Intra-interspecific competition
- -42 F reduced overwintering populations



Enoclerus lecontei Photo: Aaron Schusteff



Management: Pheromones

- No aggregation pheromone
- Rely on host volatiles

Lack of evidence for pheromone-mediated secondary attraction in the fir engraver, *Scolytus ventralis* (Coleoptera: Scolytidae)

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ABSTRACT

To test the hypothesis that host selection and mass attack by the fir engraver, *Scolytus ventralis* LeConte, is mediated in part by pheromones, an exhaustive series of experiments was conducted. Gas chromatographic (GC) analysis and GC-electroantennographic detection analysis was performed on Porapak Q-captured volatiles from virgin and mated beetles of both sexes, logs of grand fir, *Abies grandis* (Dougl.) Lindl., with males, females or both sexes boring in the bark, and trees undergoing attack in the field, and on extracts of abdominal tips from beetles topically-treated with methoprene, a juvenile hormone analogue, or beetles boring in methoprene-treated bark of grand fir. None of these analyses disclosed any sex-specific compounds or compounds that changed markedly in concentration following treatment. Extracts of the females' terminal abdominal glands with associated vaginal palpi contained *exo*-brevicomin, a common aggregation pheromone in the genera *Dendroctonus* and *Dryocoetes*, but laboratory and field experiments showed it to have no apparent role in long-range orientation. Extensive visual and videotaped observations revealed that females walking on grand fir bark displayed apparent "calling" and "marking" behavior, and during courtship males rubbed the females' abdominal declivity with their frons, placing their antennae in juxtaposition to the females' vaginal palpi. These results are consistent with the alternative hypothesis that host selection and mass attack by *S. ventralis* are mediated solely by primary attractants from the host tree, but they do not rule out the possibility of short-range pheromone-mediated behavior.



Management: Direct Control

- Impractical:
 - Removal of trees infested with fir engraver broods and trees in poor condition that are likely to provide breeding habitat are ineffective at halting a drought-induced outbreak once it has begun
- But...
 - Hot summers & drought = trees fading the same year they're attacked, larvae are still in the tree: **cut and burn before flight!**



Management: Silviculture

- Cut all fir



Management: Silviculture

- Thin overstocked true fir stands
 - Remove:
 - Decadent and weakened firs
 - White and red fir with poor crown condition and live crown ratios
- Decrease the extent and occurrence of true fir on mixed conifer sites
 - Encourage the growth of non-host, site-adapted species
 - Species conversion or increased species diversity should be considered



Management: Silviculture

- Fir engraver can breed in fresh slash with a diameter > 4 inches
 - Avoid creating large pieces of true fir slash during their flight period
 - Remove fresh windthrow, logging slash and fire-damaged material before fir engraver flight
 - Large numbers of cull stems should not be left in the forest after a logging operation
- Minimize soil compaction
- Minimize damage to residual trees



Management: Silviculture

- Thinning is your best bet for control, but...
 - Removing trees on root disease centers has been shown to worsen their severity, which may in turn cause these stands to become more susceptible to fir engraver than they were before
 - Trees growing in dense true fir stands that have failed to develop good crown ratios may make leave trees susceptible to thinning shock



Acknowledgements

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