

Why Are Insects and Diseases Important?

Native insects and diseases are a natural part of ecosystems and are essential to the ecological balance in natural forests (Castello and others 1995). In contrast, nonnative insects and diseases can pose a particular threat because ecosystems often lack natural internal controls of these agents. The activity of both native and nonnative insects and pathogens (i.e., disease-causing microorganisms) is related to a suite of both natural and anthropogenic factors such as climate and management activities. Insects and diseases can influence patterns and processes of forested landscapes mostly through tree mortality or reduced tree vigor, which in some cases result in ecological or economic impacts, or both.

Methods

Nationally compiled Forest Health Protection (FHP) aerial survey data from 2003 were used to assess insect and disease activity at the landscape level. In the aerial surveys, areas of defoliation and mortality caused by insects and pathogens were mapped and the causal agent identified.

A particular species of insect or pathogen might be identified as a defoliation-causing agent in one location and as a mortality-causing agent in another, depending on the level of damage to the forest in a particular area. In 2003, aerial surveys were conducted over a majority of the forested area of the conterminous United States (fig. 6.1). The exposure of forests to mortality- and defoliation-causing agents was assessed within each Forest Health Monitoring (FHM) region. Exposure was defined as the area in hectares with mortality- or defoliation-causing agents present. The analysis was based on relative exposure (observed vs. expected) on a county basis within each FHM region and was used to identify hotspots of activity during 2003 [e.g., see Kulldorff (1997) and Coulston and Riitters (2003)]. The observed exposure was the number of hectares in each county with activity, and the expected exposure in hectares was calculated for each region based on a Poisson model (Coulston and others 2005). Relative exposure ranges from 0 to infinity, where values < 1 represent low relative exposure and less than expected defoliation or mortality within the region. A value > 1 represents more than

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Chapter 6. Insect and Disease Activity (2003)

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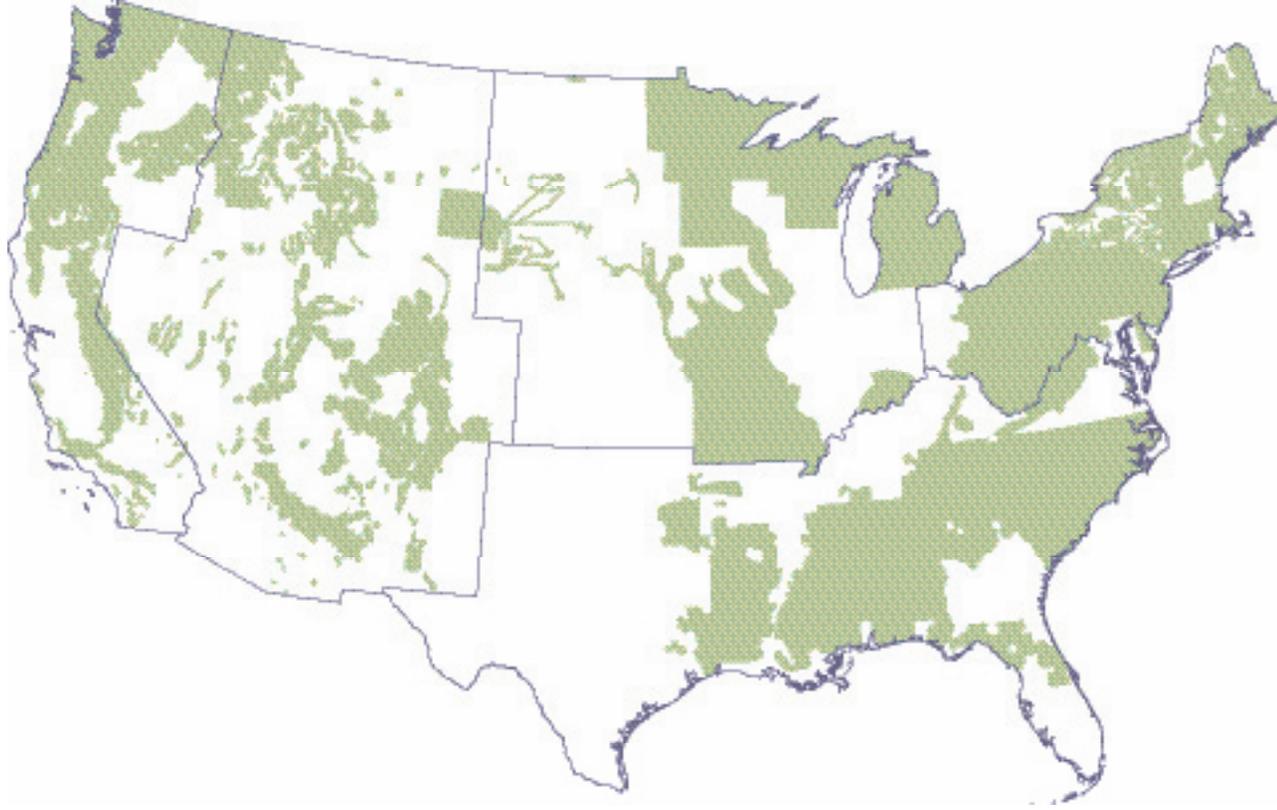


Figure 6.1—The extent of aerial surveys for insect and disease activity conducted in the conterminous United States in 2003 (shown in green). The purple lines delineate the Forest Health Monitoring program regions. (Data source: U.S. Department of Agriculture Forest Service, Forest Health Protection.)

expected exposure to defoliation- or mortality-causing agents within the FHM region of interest. The measure is linear, so a relative exposure value of 2 indicates an area has experienced twice the exposure expected for the region.

What Do the Data Show?

Several forested areas in the Northeast FHM region had high relative exposures to mortality-causing agents. Portions of sections 212G–Northern Unglaciaded Allegheny Plateau and M221B–Allegheny Mountains experienced more than six times the expected exposure (fig. 6.2A). Some of the reported mortality was due to beech bark disease. As a result of balsam woolly adelgid and decline,¹ much of the forested area in section M212C–Green, Taconic, Berkshire Mountains had more than twice the expected exposure to mortality-causing agents. The most intense areas of defoliation activity in the Northeast FHM region were in sections M221A–Northern Ridge and Valley and 221A–Lower New England (fig. 6.2B). Gypsy moth accounted for most of the defoliation-causing activity in the Northern Ridge and Valley section. In

Lower New England, spanworm and forest tent caterpillar accounted for most of the activity.

The forest tent caterpillar was also active in the South FHM region, causing defoliation in parts of sections 232C–Atlantic Coastal Flatlands and 232B–Coastal Plains and Flatwoods, Lower, in South Carolina (fig. 6.2B). The only other agent reported as causing defoliation damage in the South FHM region in the 2003 national aerial survey data was gypsy moth (in Virginia). The forest tent caterpillar and the baldcypress leafroller caused mortality in sections 234A–Mississippi Alluvial Basin and 232E–Louisiana Coast Prairies and Marshes Section (fig. 6.2A).

Most mortality-causing insect and disease activity in the North Central FHM region was concentrated in four ecoregion sections (fig. 6.2A). Emerald ash borer caused mortality in sections 222I–Erie and Ontario Lake Plain and 222J–South-Central Great Lakes. In section 212H–Northern Great Lakes, annosus root disease, beech bark disease, and oak wilt caused mortality. Mountain pine beetle accounted for a majority of the mortality-causing activity in section M334A–Black Hills. Relative exposure to

¹ Specific causal agents were not identified in the FHP database.

defoliation-causing insects and diseases was high in sections 212L–Northern Superior Uplands, 212M–Northern Minnesota and Ontario, and 212N–Northern Minnesota Drift and Lake Plains (fig. 6.2B). Most of this defoliation, particularly in section 212L–Northern Superior Uplands, was caused by the forest tent caterpillar.

In 2003, there were several hotspots of mortality-causing insect and disease activity in the Interior West FHM region (fig. 6.2A). Pinyon pine mortality² was most intense in parts of sections 313A–Grand Canyon and M331G–South-Central Highlands. Forests in section M331I–Northern Parks and Ranges also experienced high relative exposure to mortality-causing agents. Mountain pine beetle accounted for much of this activity. There were also several hotspots of defoliation-causing insect and disease activity (fig. 6.2B). Some forested areas in section M313A–White Mountains–San Francisco Peaks–Mogollon Rim had exposure rates more than six times the expected levels. This high relative exposure was mostly due to western spruce budworm, spruce aphid, and aspen defoliation.³ The western spruce budworm

was mostly responsible for areas of high relative exposure in sections M331F–Southern Parks and Rocky Mountain Ranges, M332A–Idaho Batholith, M332D–Belt Mountains, and M332E–Beaverhead Mountains.

Parts of the West Coast FHM region had higher than expected exposure to mortality-causing insects and pathogens in 2003 (fig. 6.2A). Several areas in sections M261G–Modoc Plateau and M261E–Sierra Nevada had more than twice the expected rates of exposure to mortality-causing agents. Much of this activity was from bark beetles. In section M262B–Southern California Mountains and Valleys, multi-insect and disease damage caused mortality. Parts of section M242A–Oregon and Washington Coast Ranges had more than six times the expected exposure rate to defoliation-causing insects and diseases (fig. 6.2B). Much of the defoliation in this ecoregion section was caused by Swiss needle cast. Parts of section M242C–Eastern Cascades also had more than six times the expected exposure rate, but in this case, western spruce budworm was responsible for most of the defoliation.

² The specific mortality-causing agents were not identified in the FHP database.

³ The specific causes of defoliation were not identified in the FHP database.

Overall, in 2003, 48 different species of mortality-causing agents were recorded during aerial surveys of the conterminous United States. Of these species, mountain pine beetle, Douglas-fir beetle, fir engraver, and southern pine beetle were the most frequently observed. Fifty-four different species of defoliation-causing agents were recorded in the conterminous United States during 2003. Of these defoliation-causing agents, forest tent caterpillar, Swiss needle cast, western spruce budworm, and gypsy moth were most frequently observed. Continued monitoring of forested areas is important to determine when the activity of insects and diseases that cause mortality or defoliation warrants follow-up investigation or management action.

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Appendix—Common and scientific names of cited forest pest species

Common name	Scientific name
Annosus root disease	<i>Heterobasidion annosum</i>
Baldcypress leafroller	<i>Archips goyerana</i>
Balsam woolly adelgid	<i>Adelges piceae</i>
Beech bark disease	<i>Nectria coccinea</i> var. <i>faginata</i>
Douglas-fir beetle	<i>Dendroctonus pseudotsugae</i>
Emerald ash borer	<i>Agrilus planipennis</i>
Fir engraver	<i>Scolytus ventralis</i>
Forest tent caterpillar	<i>Malacosoma disstria</i>
Gypsy moth	<i>Lymantria dispar</i>
Mountain pine beetle	<i>Dendroctonus ponderosae</i>
Oak wilt	<i>Ceratocystis fagacearum</i>
Southern pine beetle	<i>Dendroctonus frontalis</i>
Spruce aphid	<i>Elatobium abietinum</i>
Swiss needle cast	<i>Phaeocryptopus gaumannii</i>
Western spruce budworm	<i>Choristoneura occidentalis</i>