Chapter 6. Insects and Diseases

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Introduction

Insects and diseases are a natural part of forested ecosystems. Their activity is partially regulated by biotic factors, e.g., host abundance, host quality; physical factors, e.g., soil, climate; and disturbances (Berryman 1986). Insects and diseases can influence both forest patterns and forest processes by causing, for example, defoliation and mortality. These effects may occur at small scales (gap phase) or large scales (forest development) and at any seral stage (Castello and others 1995). It can be useful to examine population trends for individual insect or pathogen species. However, for broadscale analysis, examining the cumulative effects of insects and pathogens gives a representation of ecosystem stress over time.

Methods

I used the nationally compiled Forest Service Forest Health Protection (FHP) aerial survey data from 1998 through 2004 (see footnote 3 in chapter 1) to assess insect and disease activity at the landscape level. 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 currently active hotspots of activity (Coulston and Riitters 2003, Kulldorff 1997). Relative exposure could range from zero to infinity, where <1 represented low relative exposure and less-than-expected defoliation or mortality within the region. A value >1 represented more-than-expected exposure to defoliation- or mortality-causing agents within the FHM region of interest. The measure is linear, so, for example, a relative exposure value of 2 would indicate that an area had experienced twice the exposure expected for the region. While information from 1998 through 2004 was used to calculate the relative exposure, only counties with activity in 2004 have a relative exposure value greater than zero displayed on the maps.

Mortality-Causing Agents

In the Northeast FHM region, forest areas in ecoregion sections 211C—Fundy Coastal and Interior and 211B—Maine—New Brunswick Foothills and Lowlands experienced more than six times the expected exposure to mortality-causing agents from 1998–2004 (fig. 6.1). Balsam woolly adelgid accounted for most of this activity, which peaked in 2002; however, there was still activity in 2004. In the South FHM region, forested areas in sections 221J—Central Ridge and Valley, 221H—Northern Cumberland Plateau, M221D—Blue Ridge Mountains, and 231A—Southern Appalachian

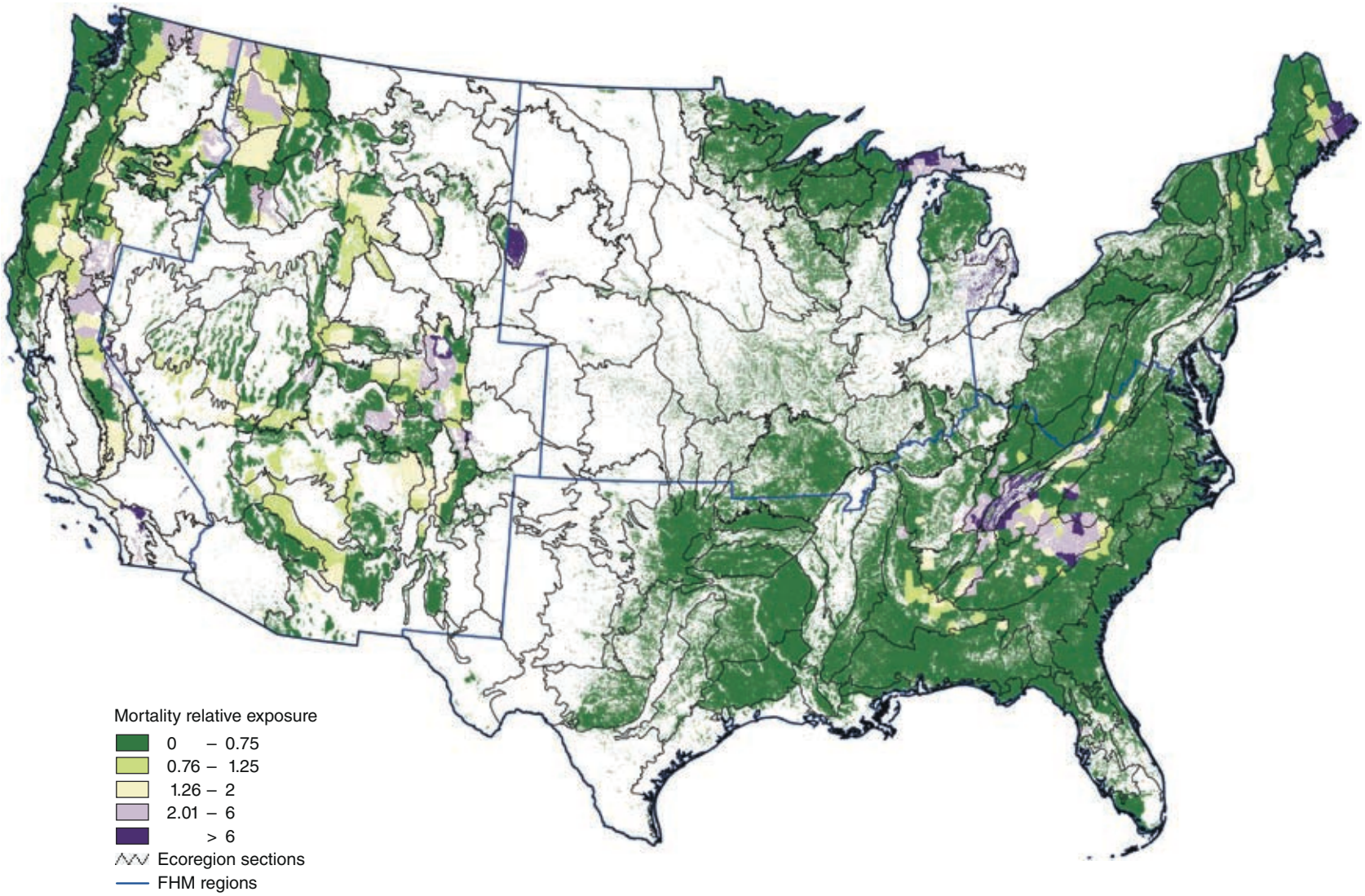

Figure 6.1—The 1998–2004 relative exposure by FHM region for forested areas with currently (2004) active mortality-causing agents. The gray lines delineate ecoregion sections (Cleland and others 2005, McNab and others 2005). Forest cover source was the U.S. Department of Agriculture Forest Service, Remote Sensing Applications Center. (Data source: U.S. Department of Agriculture Forest Service, Forest Health Protection)

Piedmont experienced more than six times the expected exposure to mortality-causing agents. This activity was attributable to southern pine beetle. Much of the forested area in section 221J—Central Ridge and Valley had a relative exposure of greater than six (fig. 6.1); however, the southern pine beetle activity in that section peaked in 2001 and has decreased since 2003 (fig. 6.2). In the North Central FHM region, forested areas in sections M334A—Black Hills and 212R—Eastern Upper Peninsula had relative exposures of more than six (fig. 6.1). In section M334A—Black Hills, mountain pine beetle accounted for most of the activity. In section 212R—Eastern Upper Peninsula, beech bark disease caused most of the recorded mortality in 2004. In the Interior West FHM region, section M331I—Northern Parks and Ranges had some forested areas exposed to more than six times the expected activity. Most of the activity was attributable to mountain pine beetle, Douglas-fir beetle, fir engraver, and spruce beetle. In the West Coast FHM region, forested areas in section M262B—Southern California Mountain and Valley had more than six times the expected exposure rate to mortality-causing agents (fig. 6.1). Most of the mortality was attributed to bark beetles.

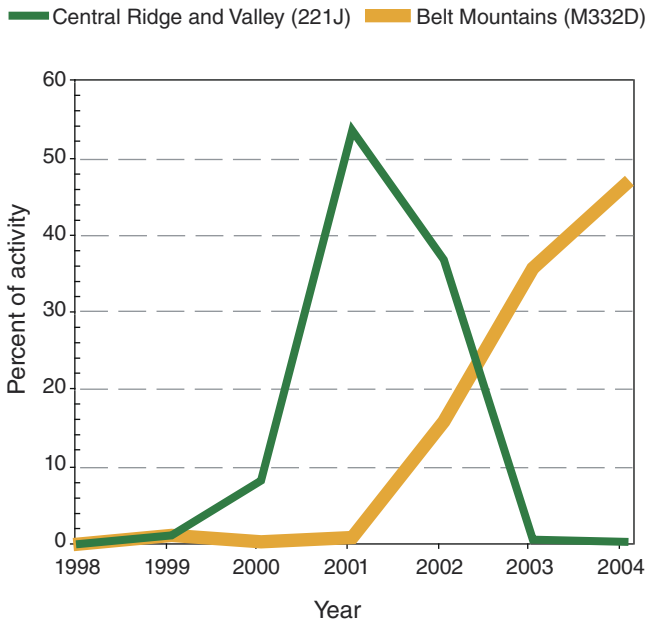

Figure 6.2—Temporal distribution of mortality-causing activity in ecoregion section 221J - Central Ridge and Valley. Most of the activity was attributable to southern pine beetle. Temporal distribution of defoliation-causing activity in ecoregion section M332D - Belt Mountains. Most of the activity was attributable to western spruce budworm. (Data Source: U.S. Department of Agriculture Forest Service, Forest Health Protection)

Defoliation-Causing Agents

Ecoregion section 221A—Lower New England in the Northeast FHM region had several areas exposed to more than six times the expected rate of defoliation-causing agents (fig. 6.3). In 2004, winter moth, forest tent caterpillar, and gypsy moth were active in this section. In the South FHM region, forest tent caterpillar continued to

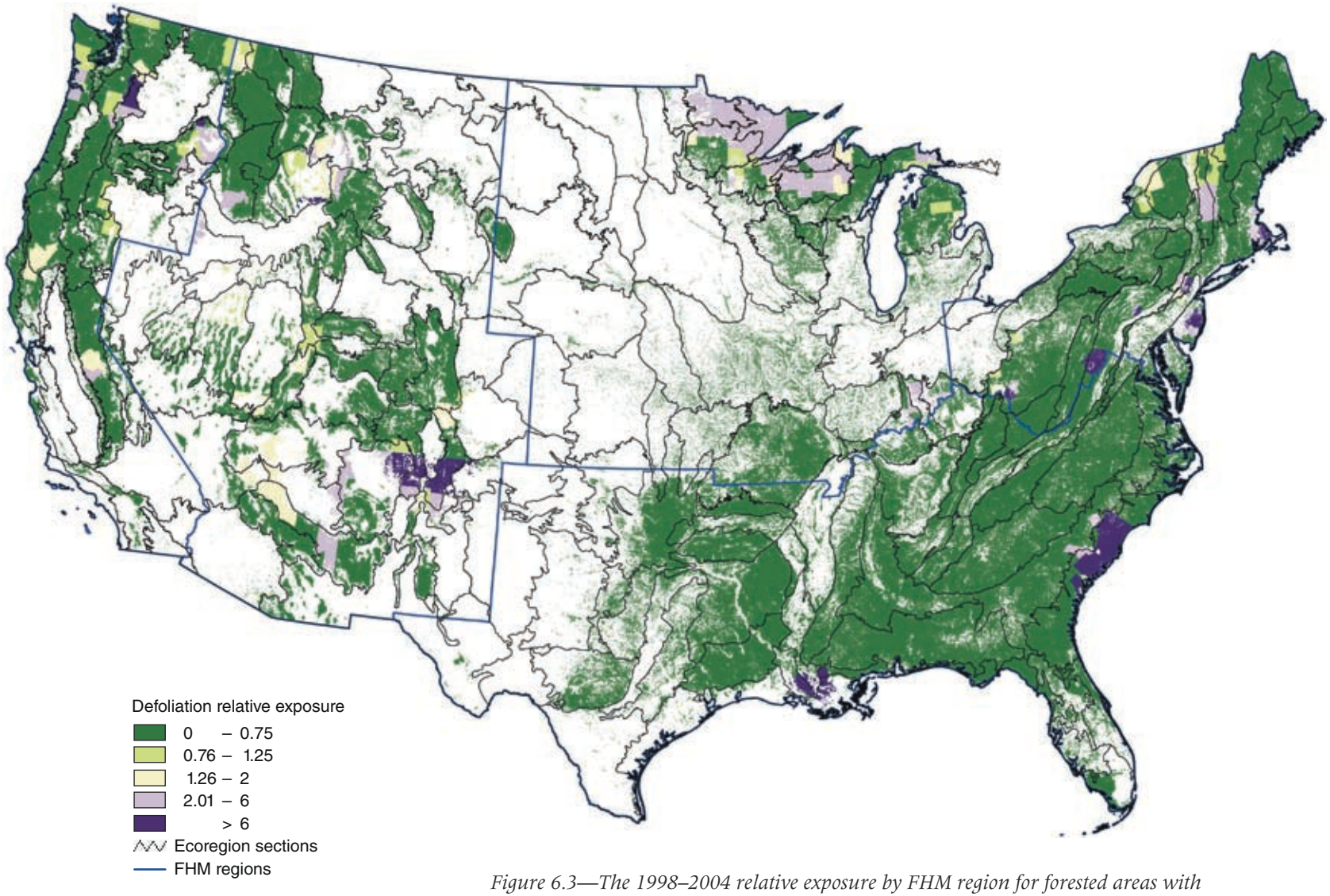

Figure 6.3—The 1998–2004 relative exposure by FHM region for forested areas with currently (2004) active defoliation-causing agents. The gray lines delineate ecoregion sections (Cleland and others 2005, McNab and others 2005). Forest cover source was the U.S. Department of Agriculture Forest Service, Remote Sensing Applications Center. (Data Source: U.S. Department of Agriculture Forest Service, Forest Health Protection)

defoliate parts of section 232C—Atlantic Coastal Flatwoods. In sections 232E—Louisiana Coastal Prairie and Marshes and 234C—Atchafalaya and Red River Alluvial Plains, bald cypress leaf roller and forest tent caterpillar contributed to defoliation in excess of six times the expected rate. In the North Central FHM region, forests in province 212—Laurentian Mixed Forest had relative exposures to defoliation-causing agents 2 to 5.99 times the expected rate (fig. 6.3). Several insects caused this defoliation including the spruce budworm, jack pine budworm, and eastern larch beetle. In the Interior West FHM region, sections M331F—Southern Parks and Rocky Mountain Range and M331G—South-Central Highlands had forested areas exposed to more than six times the expected exposure rate to defoliation-causing agents (fig. 6.3). Forests in section M332D—Belt Mountains in Montana also experienced more than six times the expected exposure to defoliation-causing agents (fig. 6.3). Most of the defoliation was caused by western spruce budworm activity, which has increased since 2001 (fig. 6.2). In the West Coast FHM region, forests in the northern part of section M242C—Eastern Cascades experienced more than six times the expected exposure rates (fig. 6.3).

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