Chapter 9. Summary

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Forest Health Monitoring (FHM), together with cooperating researchers both in and outside of the Forest Service, continues to investigate a variety of issues relating to forest health. This report provides some of the latest analyses and results. The broad range of indicators presented demonstrates one reason it can be difficult to draw general conclusions about the condition of U.S. forests.

A number of stressors are affecting U.S. forests to varying degrees. Drought periodically affects nearly all U.S. forests to some extent. In 2005, the worst drought (9 months) occurred in ecoregion section M332G—Blue Mountains. Over the past decade (1996–2005), much of the Interior West of the United States was considerably more droughty than the historic average. Much of the Southeast was slightly more droughty than the historic average over the same period. With some exceptions, ecoregion sections of the remainder of the Eastern United States as well as the West Coast experienced the expected amount of drought, or less, over that period.

Fire also periodically affects many U.S. forests, and managing the risk of catastrophic fire is an important issue. An analysis of lightning as an ignition source for forest fires suggests that lightning flash density can serve as a predictor of where forest fires are likely to occur in the Eastern United States and in parts of the West. Therefore, in those areas lightning data might be used as a tool for prioritizing efforts to reduce fuel loads and, thus, reduce the risk of wildfire.

Anthropogenic stressors, such as air pollution, are a concern because of possible impacts on forest health and productivity. Analyses of National Atmospheric Deposition Program (NADP) pollution data showed a strong eastwest gradient in wet sulfate and nitrogen (NO_3^- and NH_4^+) deposition, with the highest deposition levels being in the Northeast FHM region. Ozone followed a different pattern. SUM06 ozone exposures were highest in the Interior West FHM region. The Forest Inventory and Analysis (FIA) lichens indicator was also used to understand the effects of pollution on forests in the Pacific Northwest (PNW).

Although the NADP data show air pollution to be relatively low throughout the PNW, a gradient model relating lichen communities to pollution indicates relatively high levels of nitrogen deposition mostly concentrated in ecoregion section 242A—Willamette Valley and Puget Trough. It is possible that even nitrogen deposition levels that are quite low compared with the Eastern United States are capable of negatively affecting lichen communities. It is a lso possible that through dry deposition parts of the PNW are receiving much higher nitrogen inputs than are indicated by the wet deposition analysis alone.

A variety of insects and pathogens affect U.S. forests. Many different species of mortality- and defoliation-causing agents were recorded during aerial surveys of the conterminous United States from 1998 through 2004. Analyses of relative exposure to defoliation- and mortality-causing agents identified hotspots of insect and pathogen activity in each FHM region. Of mortality-causing species, southern pine beetle was most frequently observed in the South FHM region and balsam woolly adelgid in the Northeast. In the North Central region, beech bark disease was frequently observed in northern Michigan while mountain pine beetle was observed in the Black Hills of South Dakota. In the Interior West region, mountain pine beetle, Douglas-fir beetle, fir engraver, and spruce beetle were responsible for high relative exposures. In the West Coast FHM region, areas of high mortality were attributed to bark beetles. Continued monitoring of forested areas is important to determine when the activity of insects and pathogens warrants followup investigation or management action.

Both native and exotic insects and pathogens have the potential to damage U.S. forests, but exotic pests, lacking biological controls found in their lands of origin, can be especially harmful. An analysis of quantities of freight coming into the United States and the locations where exotic insects were first discovered showed that several recently introduced exotic insect pests first established themselves in the vicinity of major marine ports. Also, several ecoregions have high proportions of their forested area within 100 miles of marine ports, which might provide venues where newly imported exotic pests can become established in the future.

Crown condition is an indicator of the health of trees because it reflects the amount of tissue available to the tree for photosynthesis. Analyses of FIA crown indicator data showed no areas of outstandingly poor crown condition that would be indicative of large-scale, generalized forest health problems when data from all hardwoods or all softwoods were examined as a group. However, when crown condition was analyzed by tree species group, spatial clusters of plots where trees had high crown dieback, high foliar transparency, or low crown density were identified in both the Western and Eastern United States. Most of these clusters were located within regions experiencing stress from known agents such as weather events, insects, and pathogens. Many of the causal agents co-occurring with clusters of relatively poor crown condition were insects or pathogens specific to certain tree species or genera. Further investigation will be required to identify the causal agents responsible for relatively poor crown conditions in the few species for which no cause is apparent.

The results presented in this report reflect output from FHM's national-scale detection monitoring efforts. It is possible to fail to detect national-scale forest health problems if the indicators being measured do not show a strong signal relative to the natural variability in forest conditions. Whenever a potential forest health problem is discovered through such large-scale analyses, it is important to follow up with more detailed study to verify the findings and determine the extent and seriousness of the issue. Also, it is important to be aware that forest health issues of local or regional importance may exist which, because of their small scale, are not detected in these analyses. Other reports produced by FHM and its partners often address smaller scale forest health issues that are not covered in these national-scale analyses.