Indicator 3.15.

Area and Percent of Forest Affected by Biotic Processes and Agents (e.g., Insects, Disease, Invasive Alien Species) Beyond Reference Condition

What is the indicator and why is it important?

Observed activity and effects from key biotic agents and processes measured by Indicator 15 show deterioration in forest ecosystem health and vitality and decline in forest sustainability. The "reference condition" is defined as the previous reporting period (1997 to 2002) used in the *National Report on Sustainable Forests—2003*. Current analysis of these agents and processes, systematically measured at regular intervals and contrasted with the reference condition provides information in support of practical forest health planning and management. The indicator is based on primary collection of insect and disease mortality and defoliation data (mainly through aerial survey) that are augmented by modeling and analysis techniques. The methodology is repeatable, and, with a growing database, increasingly reliable.

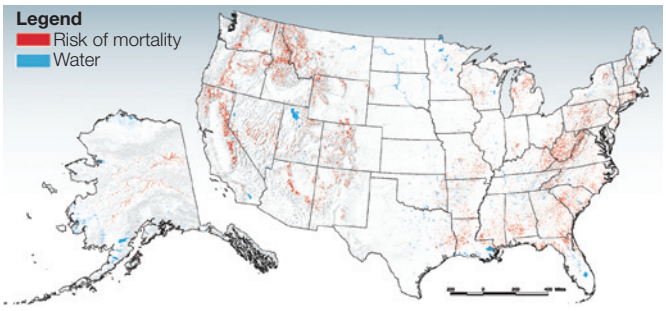
What does the indicator show?

Figure 15-1 shows areas of predicted risk of disturbance by biotic agents; risk is defined as 25 percent loss of standing volume over the next 15 years. Figure 15-2 shows areas with broadscale forest decline and tree mortality detected for this indicator during the past 5 years. Recently mapped effects show a three-fold increase in readily detectable damage, relative to the reference period, representing a significant departure from reference condition, deterioration in forest ecosystem health, and a threat to forest sustainability (fig. 15-3).

Within the broad context of this cursory report, evidence that biotic processes and agents are significantly out of range lies in what is directly observed and what is inferred (by extrapolating these results to account for understory effects not readily observed and to areas not regularly monitored, and by predicting risk into the future). Not described in detail within this report, yet detected and reportable at finer resolution are localized departures from reference condition. As predicted by risk modeling, and confirmed by site specific observations, actual effects at local or regional levels are often extreme.

Overall, the indicator shows a continuing and increasing trend in forest decline. Spikes in tree mortality during the reporting period are largely because of a combination of high stand density

Figure 15-1. Predicted insect and disease risk equals 58 million acres (red) based on national 2006 composite.

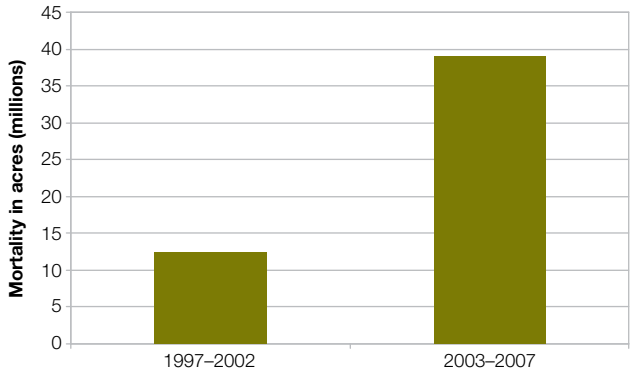


Source: USDA Forest Service, Forest Health Protection

Figure 15-2. Areas with mortality mapped from 2003–2007.

Source: USDA Forest Service, Forest Health Protection

Figure 15-3. Cumulative total area with mortality for select agents in the lower 48 States (cumulative effects occur where mortality continues in previously mapped areas and expands into new areas).



Source: USDA Forest Service, Forest Health Protection

in unmanaged forests and drought, which both increase the likelihood of insect outbreaks. Cumulative effects of insects, disease and a complex of other environmental factors are occurring within previously surveyed areas and expanding into new areas.

Forest health damage detection (including both aerial and ground methods) results presented in this report cover a high proportion but not all of the total forested area. Annual aerial detection surveys cover approximately 70 and 20 percent of the total forested area in the lower 48 States and Alaska respectively. Consequently, the departure from reference conditions may be underestimated.

What has changed since 2003?

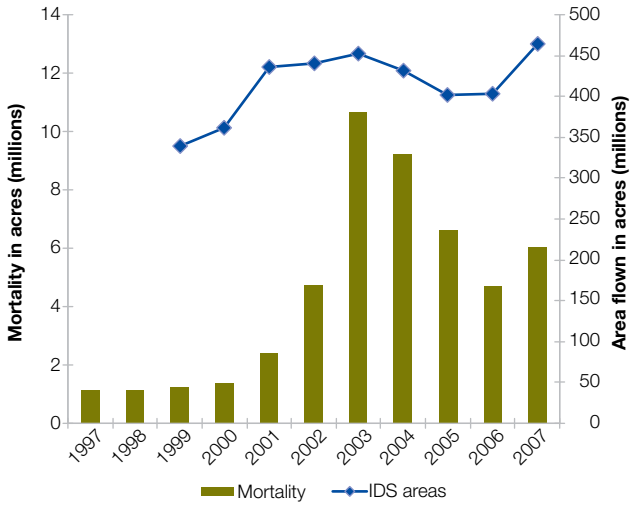
Annual mortality estimates within the past decade peaked in 2003 (fig. 15-4) then declined somewhat during subsequent years. The overall trend continues to increase, however. (A similar trend is evident for Alaska—see data report for details.) Mortality within any given year during the current period has not dropped below any given year during the reference period for the lower 48 States. Within the lower 48 States cumulative total forested area with mortality has increased to 37 million acres, compared to the reference condition of 12 million acres. Bark beetle, engraver beetle, gypsy moth-caused mortality, and mortality in the pinyon-juniper type because of complex factors, are leading contributors to increased mortality rates. Areas affected by root disease are documented as decreasing (see data report); however, it should be noted that currently reported insect-caused mortality often includes insect and disease complexes, so disease acreage is probably higher than recorded. Cumulative total forested area with defoliation has decreased by approximately 60 percent compared to reference conditions (see data report). Some of this decrease is attributable to gypsy moth suppression and eradication efforts and repeated defoliation events, moving those areas into the mortality category. The cumulative total forested area with mortality and defoliation since 2003 is approximately 50 million acres or 8 percent of the total hardwood and conifer forested area (considering all agents, not restricted to those specifically addressed in this report).

Do important regional differences exist?

Cumulative effects from both native and nonnative pests are particularly evident at regional scales. Important regional effects from specific agents upon local ecosystems are often masked when these data are presented nationally.

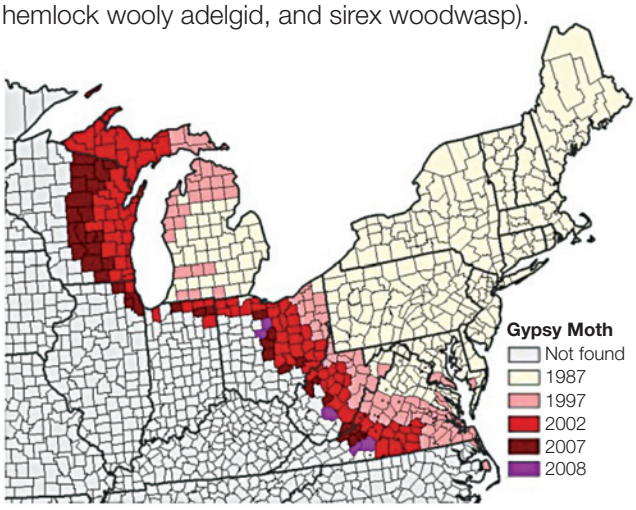
Nonnative invasive plants, insects, and diseases include: sudden oak death and Port-Orford cedar root disease in the West; gypsy moth (fig. 15-5), hemlock woolly adelgid, sirex woodwasp, and emerald ash borer in the Northeast; salt-cedar in the Southwest, chestnut blight and butternut canker in the East; white pine blister rust, Dutch elm disease, tree-of-heaven, spotted knapweed and more. These often become established and readily spread within forested regions currently out of the range of natural variability. For example, stands becoming dominated by tanoak because of a variety of factors (shade tolerant dominance resulting from fire exclusion, absence of harvest practices that increase age and species diversity, and so on) provide optimum conditions for the pathogen responsible for sudden oak death to become established and spread.

Figure 15-4. Survey results for mortality and flown insect and disease survey areas within the lower 48 States; includes areas with pinyon, oak, and aspen mortality, select beetles, and root diseases for other tree species (reporting area flown began in 1999).



IDS = Insect and Disease Survey
Source: USDA Forest Service, Forest Health Protection

Figure 15-5. Gypsy moth effects and quarantine progression, 1987–2008; although geographic distribution varies, similar displays are available for counties confirmed with sudden oak death, emerald ash borer, hemlock wooly adelgid, and sirex woodwasp).



Source: USDA Forest Service, Forest Health Protection

Native pest activity similarly threatens sustainability by affecting normal tree species distribution and the overall number and extent of live trees at regional scales. Examples include an insect complex in southern California in 2003, spruce beetles on Douglas-firs in the Northwest, and mountain pine beetle in the Rocky Mountains.

Unique to Alaska is the issue of yellow cedar decline. The leading cause of yellow cedar decline appears to be freeze injuries to roots because of low snow pack. Cumulative acreage totals show a 24-fold increase in yellow cedar decline over reference condition.

Monitoring regional effects is critical to early detection to apply management strategies for prevention and control within (1) affected areas, (2) areas currently in a predisposed condition, and (3) areas for which, without management, sustainability will soon be at risk.