

An hourglass-shaped graphic with a globe inside. The top bulb is dark blue, and the bottom bulb is light blue. The globe is a darker shade of blue. The hourglass is centered on the page.

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FOREST ECOSYSTEM HEALTH: AN OVERVIEW

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Abstract. Although most U.S. forests are in better condition than they were a century ago, many forest ecosystems, especially in the intermountain west, are widely thought to be in poor health. Interest groups disagree over what constitutes a healthy forest, what has caused the problems, and what the solutions are. Nonetheless, most accept that high biomass accumulations—dead and dying trees, dense undergrowth, and stands of small trees—can contribute to catastrophic wildfires, pest problems, and lower biological diversity. A variety of tools and approaches have been proposed and debated to address the problems, including salvage and other timber sales, prescribed burning, and other treatments. Legislative and administrative efforts have generally focused on the national forests, to create new forest health programs and management tools or to authorize alternative treatment approaches.

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Forest Ecosystem Health: An Overview

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Summary

Although most U.S. forests are in better condition than they were a century ago, many forest ecosystems, especially in the intermountain west, are widely thought to be in poor health. Interest groups disagree over what constitutes a healthy forest, what has caused the problems, and what the solutions are. Nonetheless, most accept that high biomass accumulations — dead and dying trees, dense undergrowth, and stands of small trees — can contribute to catastrophic wildfires, pest problems, and lower biological diversity. A variety of tools and approaches have been proposed and debated to address the problems, including salvage and other timber sales, prescribed burning, and other treatments. Legislative and administrative efforts have generally focused on the national forests, to create new forest health programs and management tools or to authorize alternative treatment approaches. This report will be updated as events warrant.

Congress has been discussing forest health problems and programs for more than a decade. Interest groups have supported programs to improve forest health, for a variety of reasons. Some expect such programs will increase logging and timber growth; others believe they will protect their homes and communities from catastrophic wildfires; still others feel the programs can restore natural conditions. Other groups have opposed forest health programs that include logging, arguing that logging has been a major cause of the problems, doesn't reduce the threatening biomass accumulation, and causes other environmental problems. The severe fire seasons in recent years, especially in 2000, have increased the concern, and Congress more than doubled wildfire management funding in the FY2001 Interior Appropriations Act. The Bush Administration and 107th Congress may consider several issues: whether any new programs are necessary and appropriate to improve forest health and reduce hazardous fuels; whether the new Forest Service planning regulations are desirable and effective; and what should be the funding levels for these and related programs.

The Concern Over Forest Health

Many U.S. forest ecosystems have been altered over the past century. One author notes that “forest conditions over much of the United States have improved dramatically

since 1900,”¹ but many forested areas are widely thought to be unhealthy, compared with historic (pre-settlement) conditions. Many attribute the several severe fire seasons in recent years — 1988, 1990, 1994, 1996, 1999, and 2000 — to unhealthy forest conditions, significantly raising concerns about the need to improve forest conditions.² However, there is substantial uncertainty over the nature and extent of unhealthy forest conditions.

What Is Forest Health? There is no simple definition of forest health. Most interests generally would agree that healthy forests are those that are likely to be sustained into the foreseeable future. However, people disagree about what should be sustained and how to achieve sustainability. Many emphasize sustaining forests to provide goods and services for people — some focusing on wood products, others on recreation or wildlife; some of these people believe vigorous tree growth (*i.e.*, forest productivity) is the critical factor in forest sustainability, and that tree mortality and stagnant stands are the major causes of forest health problems. Others emphasize sustaining “natural” forests, typically defined as forest conditions prior to the arrival of white settlers; many of these people argue that the pre-settlement forests are naturally sustainable,³ and that logging, grazing, fire suppression, and other activities are the major forest health problems. These differences, and the multitude of factors that affect forest health, make it difficult to reach agreement on what should be done to improve forest health.

The Nature of the Problem. Despite the differences in focus, most observers agree that there are forest health problems, generally associated with very high levels of biomass (live and dead vegetation); concerns about and possible treatments to reduce this biomass is the focus of this report. These high biomass accumulations are of concern for several reasons. First, they can contribute to wildfire conflagrations, which can destroy homes, damage resources, and alter ecosystems. High accumulations of biomass can also contribute to pest problems — invasion by exotic species (insects, diseases, weeds) that damage or displace native species, and epidemics of native insects and diseases.⁴ Finally, large biomass accumulations can reduce native biological diversity, both by creating historically unnatural forest conditions and by contributing to wildfire and pest problems that can alter biological diversity.

The nature and severity of forest health problems vary, depending on the ecosystems and on the history of the sites. In some forests (*e.g.*, spruce-fir and lodgepole pine), the problem may be widespread dead trees due to drought and/or insects or diseases. In others (*e.g.*, southern pines and western mixed conifers), the problem may be dense undergrowth of different species (palmetto in the south, firs in the west). In still others (*e.g.*, Ponderosa pine), the problem may be stand stagnation — too many small trees that

¹ Douglas W. MacCleery, *American Forests: A History of Resiliency and Recovery*, FS-540, USDA Forest Service (Durham, NC: Forest History Society, Dec. 1992), p. 49.

² For more on wildfire concerns, see CRS Report RL30755, *Forest Fire Protection*.

³ There is an ongoing debate about the role and influence of Native Americans in creating and sustaining forest conditions prior to the arrival of white settlers.

⁴ Not all would agree that epidemics of native pests is a health problem, since, for some species, periodic epidemics have occurred for centuries. However, the historically unnatural levels of biomass might also lead to epidemics that are more severe than historically natural population explosions.

are growing very slowly. In all of these cases, biomass is accumulating to historically unnatural levels, but the nature and level of biomass accumulation differs.

The problem can best be seen and may be most ecologically threatening in the many forest ecosystems (such as the southern yellow pines and Ponderosa pine) that evolved with frequent surface fires which burned the grass, pine needles, and other small fuels every 5 to 25 years, depending on the site and the plant species.⁵ These ecosystems are adapted to frequent surface fires, where most large trees survive; however, unnaturally high biomass levels can lead to stand replacement fires (where most trees are killed). In addition, the small trees and dense undergrowth can create “fuel ladders” that can carry surface fires upward into the forest canopy. Some observers are concerned that stand replacement fires in these “frequent-fire” ecosystems could lead to a permanent change in the species found in those areas.

The Extent of the Problem. Substantial uncertainty also exists over the extent of the forest health problem. Despite a decade of debate on the issue, much of the evidence is still anecdotal, although quantitative assessments are now being developed. Certain types of biomass accumulation might not be shown in the inventory data published by the Forest Service.⁶ These data are based on periodic inventories, typically on a 10-year cycle. Thus, a sudden rise in timber mortality, for example, might not be reflected in the published data until several years later. Also, species composition in mixed stands, fuel loads, and undergrowth density are not measured, because the timber inventory data are reported only for commercially useful species of harvestable size. Nonetheless, despite limited evidence in the inventory data, the forest health problem indicated by volumes of anecdotes and widespread professional agreement could be significant.

Some observers have suggested that the primary biomass accumulation problem is high timber mortality on western federal lands. The Forest Service inventory data show that timber mortality has risen on national forest lands in the west over the past two decades. However, this is not limited to national forests in the west; timber mortality has risen for most landowners and in most regions. As a percent of inventory, timber mortality on western national forests in 1996 had not risen faster or more than in other regions or for other landowners.⁷ Thus, the forest health problem does not appear to be a problem of just the national forests.

Tools For Improving Forest Health

There is considerable interest in improving forest ecosystem health: to provide immediate and/or sustainable wood supplies; to reduce the risk of catastrophic wildfires;

⁵ Other forest ecosystems evolved without frequent surface fires. Some (*e.g.*, along the Pacific Coast and in the east) have relatively high humidity, allowing biomass to rot quickly and eliminate the fuels that carry wildfires. Other tree species (*e.g.*, jack pine, lodgepole pine, and aspen) have evolved to regenerate following occasional intense fires that kill all or most of the trees in the stand (stand replacement fires). For more information, see: T.T. Kozlowski and C.E. Ahlgren, eds., *Fire and Ecosystems* (New York, NY: Academic Press, 1974).

⁶ USDA Forest Service data at: [http://fia.fs.fed.us/library/final_rpa_tables.pdf], on Jan. 9, 2001.

⁷ CRS calculations from USDA Forest Service data cited in footnote 6.

to sustain and/or protect recreation, water quality, and other outputs and values from forests; or to restore historically natural forest and wildlife habitat conditions. A principal goal of forest health improvement efforts is to reduce biomass — undergrowth and other surface biomass, small diameter trees and other fuel ladders, dead and dying trees. In mixed conifer stands, another goal may be shifting the species mix back to the historically natural pine dominance.

Several tools exist for achieving these goals. Salvage and other timber harvesting is frequently mentioned to reduce biomass in standing medium- and large-diameter trees. Salvage timber sales can be used to remove dead, dying, and threatened trees from the forest. If the trees are of commercial size, timber sales can be used to reduce the stand density or alter the species mix. However, the limbs and tree tops — “slash” — left after logging can exacerbate wildfire risks, at least until the slash has been adequately treated in one of several ways. Also, timber sales may have limited utility for removing small-diameter and low quality trees, because of the buyer’s need to process and sell the biomass for a profit. Further, some argue that commercial needs could compromise improving forest health, because a proposed sale might not be purchased unless it includes many large, valuable trees that many observers believe should be retained. Critics of timber sales also object to the environmental and ecological consequences of timber harvesting (and the related road construction), such as potential degradation of water quality, loss of soil nutrients, and fragmentation of wildlife habitat.

Another common tool is prescribed burning. This is using fire under prescribed weather and fuel conditions to reduce fuel loads. It can be effective for converting small-diameter organic matter to minerals and carbon dioxide (and other gases), but air quality standards (especially for particulates) often limit the timing, location, and extent of prescribed burning. Prescribed burning is also a poor tool for thinning small-diameter trees, because it is indiscriminate about which (if any) trees remain. Prescribed burns can also be difficult to control, as was seen in May 2000, when a prescribed fire escaped from Bandalier National Monument and burned 235 houses plus structures at a DOE nuclear weapons laboratory near Los Alamos, NM.

Other forest management techniques have also been put forth to improve forest health, including the following. Precommercial thinning cuts down trees that are too small to have much commercial value. Killing undesirable competing vegetation chemically or manually — called release — can reduce the density of undergrowth. Pruning can eliminate low-growing branches, removing the fuel ladders while improving the value of wood growth. Tree planting on mixed conifer sites can help restore the natural variation of native forests.

Oftentimes, these various tools and techniques have been used in combination to achieve the desired goals — salvage with mixed-species planting, or prescribed burning after precommercial thinning, for example. While a single tool might be sufficient to improve forest health of a particular site, the variety of different forest health problems and landowners suggests that a coordinated program of relevant tools and techniques may be necessary to improve forest ecosystem health throughout the United States.

The likely need to combine tools and their high cost has led some to propose a different approach to improving forest health in the national forests: trading goods (timber) for services (other activities in the same area). Various called land management

service contracts, stewardship contracts, and end-results contracts, among other terms, these contracts are essentially modified timber sales, where timber purchasers are required to perform other, typically related services (*e.g.*, precommercial thinning or watershed restoration), and in return pay less for the timber. However, various laws prohibit federal agencies from retaining receipts from selling assets (*e.g.*, from timber sales) without congressional authorization. To date, authorization of this approach has been enacted only as pilot programs (as described below), allowing for limited and temporary trials.

Another approach for the national forests is to contract for vegetation management activities, including timber removal, with the agency selling the timber separately. This was initially suggested as an efficiency measure in the 1960s. It has more recently been embraced by environmentalists as a way to have the treatments performed with contractor incentives based on resulting forest health rather than on timber extracted. Under this approach, contractors would be compensated if the desired stand condition were achieved; any timber removed from the site would be sold separately by the agency. Contractors would thus have no incentive to maximize the volume or value of the timber removed (as in traditional timber sales or goods-for-services contracts). However, such an approach might unnecessarily reduce the volume and value of the timber removed, and might be impractical in areas with little competition for the timber. It also might prove difficult to establish standards for assessing effective contractor performance.

Legislative and Administrative Efforts

Legislative efforts to improve forest health in the national forests have had two primary focuses: (1) creating new forest health programs in general, with authority for goods-for-services contracting and other tools to implement the new programs; and (2) authorizing goods-for-services contracting (typically to demonstrate the effectiveness of this approach for improving forest health).

Forest Health Legislation. Legislation to create new forest health programs has typically contained several provisions, including: (a) designation of priority areas for treatment; (b) authorization of activities; (c) funding mechanisms for the activities; (d) procedures for reviewing priorities and activities; and (e) requirements for monitoring and reporting on results. Not all bills have included all provisions.

The first comprehensive forest health bill identified as such was introduced in 1992. Hearings were held, and the bill was marked up, but the 102nd Congress adjourned without further action. One forest health bill in the 103rd Congress emphasized salvage timber sales and restoration of the areas burned in the relatively severe 1994 fire season. The Clinton Administration also established the Western Forest Health Initiative in 1994, although this was criticized as simply a collection of existing project proposals rather than an effort aimed at the problems resulting from the 1994 wildfires.

In the 104th Congress, the Emergency Salvage Timber Sale Program — to increase and expedite salvage sales — was enacted in the 1995 Emergency Supplemental Appropriations and Rescissions Act (P.L. 104-19). Critics of this legislation objected

particularly to provisions limiting challenges to timber sale decisions.⁸ In addition, a comprehensive forest health bill was debated in the Senate, and negotiations on a bipartisan substitute were attempted, but were unsuccessful.

In the 105th Congress, attention focused on a forest health bill which was defeated on the House floor; no comparable forest health legislation was introduced in the 106th Congress. In the Senate, hearings were held on land management planning reform, but the legislation was not enacted. The Clinton Administration revised Forest Service land management planning regulations, with final regulations issued on November 9, 2000, to give priority to ecological sustainability, which some believe will improve forest health.

Bills also have been introduced since 1995 to establish forest health programs in specific areas. Two have been enacted as separate titles of larger bills: the Herger-Feinstein Quincy Library Group Forest Recovery Act for an area in California in 1998; and the Community Forest Restoration Act for New Mexico in 2000.

More recently, attention has shifted toward wildfire protection and hazardous fuel reduction, due to the severe fire seasons in 1999 and 2000. Bills have been introduced (but not enacted) to focus new fuel reduction activities in the “urban-wildland interface.” The Clinton Administration reacted to the severe wildfires in 2000 by proposing a \$1.6 billion supplement to the Forest Service and BLM budget requests, including roughly tripling funds for hazardous fuels reduction. Congress largely enacted the proposed funding in the FY2001 Interior Appropriations Act (P.L. 106-291), and the required list of interface areas at risk was published on January 4, 2001 (66 *Fed. Reg.* 751).

Goods-For-Services Contracting. Legislation on goods-for-services contracting has typically occurred in the annual appropriations for the Department of the Interior and Related Agencies. Pilot tests of “stewardship end-results contracts” were authorized in the 102nd Congress, with two projects authorized in the FY1992 Act (P.L. 102-154) and three more in the FY1993 Act (P.L. 102-381). Senate provisions authorizing “land management stewardship contracts” for FY1991 and authorizing “land management stewardship end-results contracts” for FY1994 were not enacted.

Stand-alone bills to authorize goods-for-services contracts have been introduced, including one for broad Forest Service authority to use goods-for-services contracts to improve forest health. One demonstration bill passed both the Senate and the House in 1994, but Congress adjourned before the differences were resolved. Comparable bills were introduced in the 104th Congress, but no action was taken on those bills.

Additional projects to demonstrate goods-for-services contracting have been authorized and funded in more recent appropriations acts. A section of the FY1999 Appropriations Act for the Department of the Interior authorized 28 “stewardship end results contracts demonstration projects.” Numerous technical changes, but no additional projects, were enacted in the FY2000 Appropriations Act. Then, in the FY2001 Interior Appropriations Act, Congress authorized an additional 28 projects.

⁸ See CRS Report 96-569 ENR, *The Salvage Timber Sale Rider: Overview and Policy Issues*, and CRS Report 96-163 A, *The “Timber Rider”: Section 2001 of the Rescissions Act*.