INVITED PAPER

Development Pressures on the Private Forests

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More than 420 million acres (56 percent) of U.S. forests are privately owned (Smith and others 2009) and provide critical benefits and services to people, as well as to wildlife and ecosystems. Most of our private forests are in the eastern United States—up to 85 percent of some watersheds in the East are covered by private forest (fig. 3.2). Private forests in the West also play many important roles, including providing critical wildlife habitat (Robles and others 2008). Benefits and services from forests include a diverse array of recreational activities including fishing, hunting, hiking, and biking; habitat for over 60 percent of at-risk wildlife species in the United States (Robles and others 2008) in addition to deer, pheasants, squirrels, and many other animal and plant species not at-risk; the provision of clean air and water; timber; and carbon sequestration.

As urban development expands into rural places, and as more people choose to live near our national forests and other beautiful, rural places, housing density will likely continue to increase on nearby private forests. And, it is possible that, as current landowners become older, more private forest lands will be available for development. Currently, about 264 million acres of private forest land are owned by people age 55 or older (Butler 2008). Additionally, many private industrial timberlands have been sold over the past decade, including 23 million acres between 2000 and 2004 (Clutter and others 2005). While the majority of these lands are retained for timber management purposes, some are sold for development (Weinberg and Larsen 2008).

Impacts of housing development and other pressures on private forests—Many factors can affect the health of private forests and, hence, the benefits and services they provide. Factors range from the clearing, fragmentation, and disturbance that accompany the development of new homes and associated infrastructure; to the damage to roots, leaves, and stems caused by an associated influx of native and exotic pests and diseases; and to the soil erosion and tree mortality that follows intense wildfires. Each of these pressures can increase the potential for or exacerbate the impacts of the others.

Private forest factoids

- There are 423 million acres (56 percent) privately owned forests in the United States (Smith and others 2009).
- More than 60 percent of private forest landowners are at least 55 years old (Butler 2008).
- Between 2000 and 2004, there were 23 million acres of private industrial timberland sold in the United States (Clutter and others 2005).
- About 53 percent of U.S. water supplies originate on forest land, and more than half of this water supply comes from land on private forests (Brown and others 2005).
- Private forests supplied 91 percent of all timber harvested in the United States in 2007 (Smith and others 2009).
- About 60 percent of all at-risk animal and plant species are associated with private forests (Robles and others 2008).
- More than 57 million acres of rural private forest is projected to experience a substantial increase in housing density between 2000 and 2030; more than 70 percent of private forests in some watersheds could experience this change (Stein and others 2009).

To understand where private forests in the United States provide the greatest benefits and where these benefits are most likely to decrease due to increased housing density, fire, or insect pests and diseases, the Forests on the Edge project of the Forest Service, U.S. Department of Agriculture, undertook an assessment, based on readily available, nationally consistent GIS data. This paper provides a snapshot of the assessment as it pertains to housing density, fire, and insect pests and diseases. A complete overview of the study is presented in Stein and others (2009).

Increased housing density in rural forest lands—An assessment of projected future increases in housing density can help to understand where in the United States private forest might change as a result of future housing development. Although recent economic conditions may have led to a downturn in the housing market, given that the U.S. population is expected to increase by another 80 million people between 2000 and 2030 (U.S. Census Bureau 2004a), it is likely that housing density will continue to increase in many areas, including private forests across the country and especially in the Southeast.

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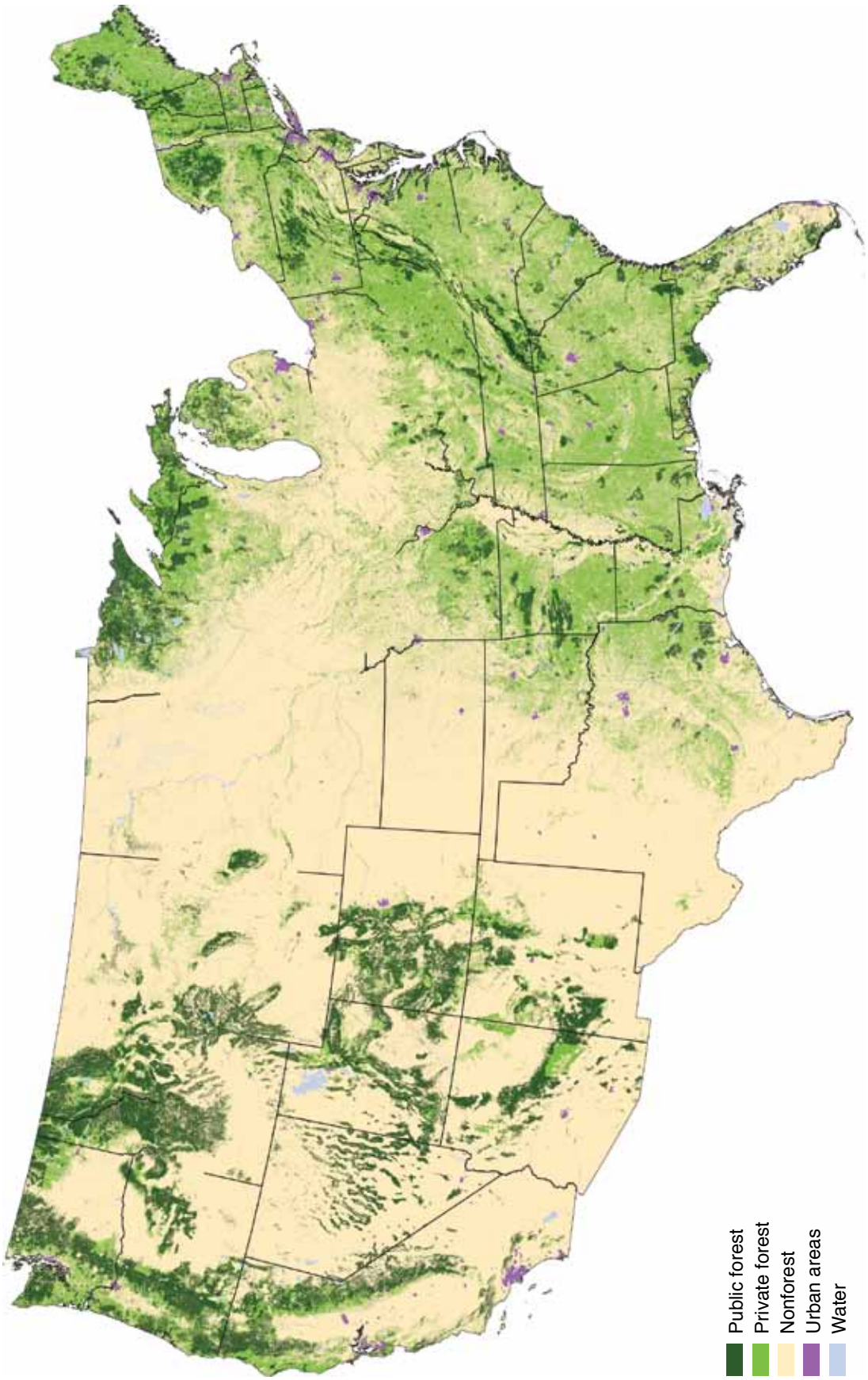

Figure 3.2—Ownership of forest lands in the United States, 2007 (Stein and others 2009).

A broad range of impacts has been associated with increased housing density and increased urbanization in and around forests (Stein and others 2009). These include decreased water quality and quantity, as well as increased volume and peak rate of runoff (Im and others 2003), higher rates of soil erosion and water pollution (Houlahan and Findlay 2004, Stein and Butler 2004), reduced carbon sequestration, and an increase in fire risk (Syphard and others 2007). Impacts to wildlife include the loss and degradation of habitat, an increase in predation, parasitism, and reproductive failures (Stein and others 2009). Studies in some areas of the country have noted that, as housing density increases, landowners are less likely to invest in timber production and active forest management (Munn and others 2002, Thorne and Sundquist 2001, Wear and others 1999).

Areas where private, rural forest lands might be most affected by substantial increases in housing density were identified by combining several GIS data layers, summarizing the results by eight-digit hydrological unit code, or watershed, and ranking each watershed by the resulting value. Layers used for this analysis included data on projected future housing density, forest cover, and land ownership. Forests were projected to experience a substantial increase in housing density if they were projected to shift from one of the following three categories into a higher-density category:

Rural I: fewer than 16 housing units per square mile
Rural II: 16 to 64 housing units per square mile
Exurban/urban: more than 64 housing units per square mile.

A detailed methodological description for these analyses can be found in Stein and others (2009).

As depicted in figure 3.3, up to 72 percent of private forests in some watersheds are estimated to experience a substantial increase in housing density between 2000 and 2030. Watersheds in the 90th percentile are found throughout the East as well as parts of the West. Many high-ranking eastern watersheds are located in or near coastal areas as well as along the Appalachian Mountain range, and include much of North Carolina and Florida, as well as an area surrounding Atlanta. High-ranking watersheds are also found in Michigan, the California Sierra Nevada Mountain range, along the Washington and Oregon Cascade Mountain range, and near major population centers in the Southwest.

Insect pests and diseases—Both native and exotic forest insects and diseases have caused substantial damage to U.S. forests. Tree defoliation and damage to roots and stems have resulted in decreased tree growth and mortality (Tkacz and others 2007). Over 5 million acres of tree mortality was caused by insects and diseases in 2006 (USDA Forest Service 2007).

Data collected and analyzed by the Forest Health Monitoring Program of the Forest Service (Krist and others 2007), when combined with data on forest ownership, allows identification of watersheds where future damage from insect pests and diseases is likely to affect tree growth on private forests. Damage by forest insects and diseases can result in decreased growth, as measured by basal area (the cross section of a tree stem in square feet, commonly measured at breast height).

Watersheds in the 90th percentile, as depicted in figure 3.4, contain private forest that could potentially experience, on average, from 16 percent to as high as 41 percent basal area loss due to forest insects and diseases. These watersheds are most numerous in western Oregon and Washington, along California's northern Sierra Nevada range, as well as in the Southwest, the vicinity of the Great Lakes, and along a section of the Appalachian highlands running from Pennsylvania through Virginia.

Wildfire—Uncontrolled, intense wildfires can threaten forests as well as the increasing number of people and structures in forested areas. Wildfire impacts can include increased soil erosion; reduced carbon sequestration; death or displacement of wildlife; alterations to stream temperature, chemistry, and sediment levels; and increased activity by off-road vehicles (Carr 2005, Donovan and Brown 2007, Hurteau and others 2009, Kalabokidis 2000). Economic repercussions of wildfire include high suppression expenditures (wildfire expenditures by the Federal Government surpassed $1 billion for the first time ever, in 2000), the loss of timberland, and a loss of tourism revenues.

Data on wildland fire potential collected by the Fire Modeling Institute of the Forest Service (http:www.fs.fed.us/fmi) were combined with data on forest ownership to identify watersheds across the country with the greatest risk of private forest damage due to wildfire under extreme conditions (Menakis 2008). As displayed in figure 3.5, up to 100 percent of the private forests located in watersheds in the 90th percentile have a high wildfire potential. A large proportion of the western watersheds included in this analysis are found in the 90th percentile category, including most of the watersheds in Arizona and New Mexico as well as watersheds in southern Colorado, northern California, and southwestern Montana. The watersheds with the highest wildland fire potential in the eastern half of the United States are all located in the South, including a band of watersheds stretching from southern Virginia through Georgia, as well as watersheds in Florida, along the border of Mississippi and Arkansas, in Texas, and in southeastern Oklahoma.

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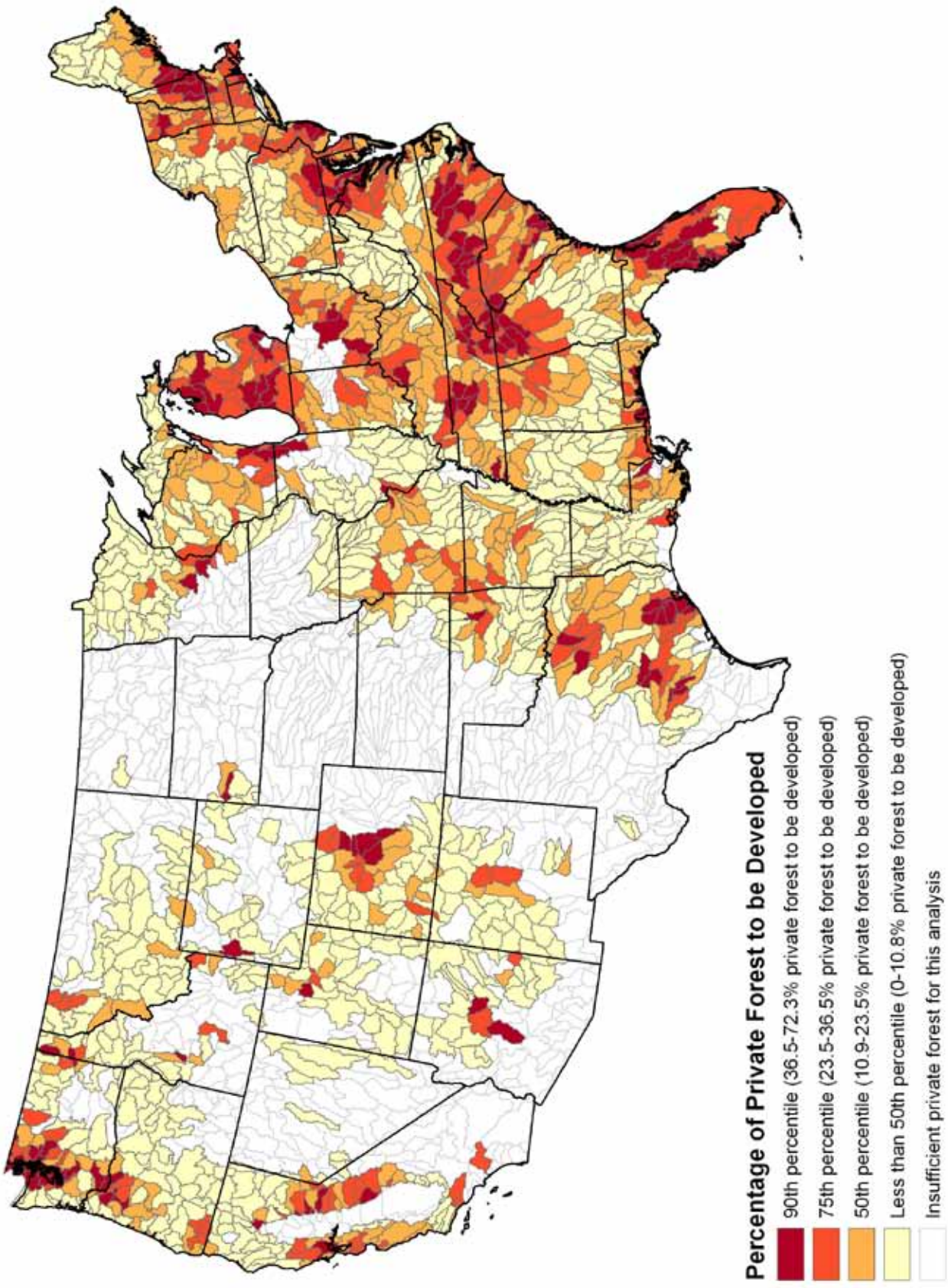

Figure 3.3—Watersheds by percentage of private forest projected to experience increased housing density.

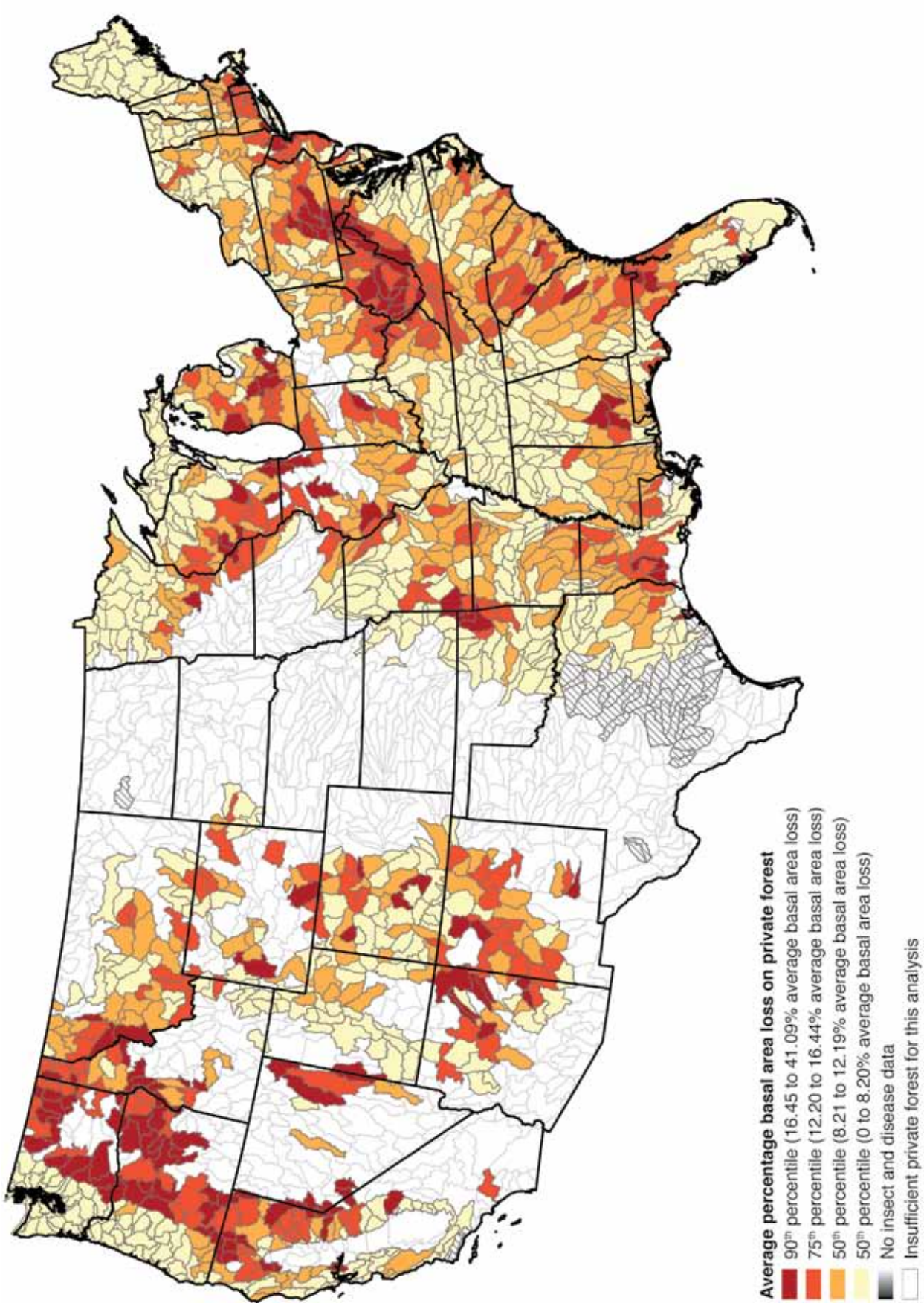

Figure 3.4—Watersheds by potential for basal area loss due to insect pests and diseases.

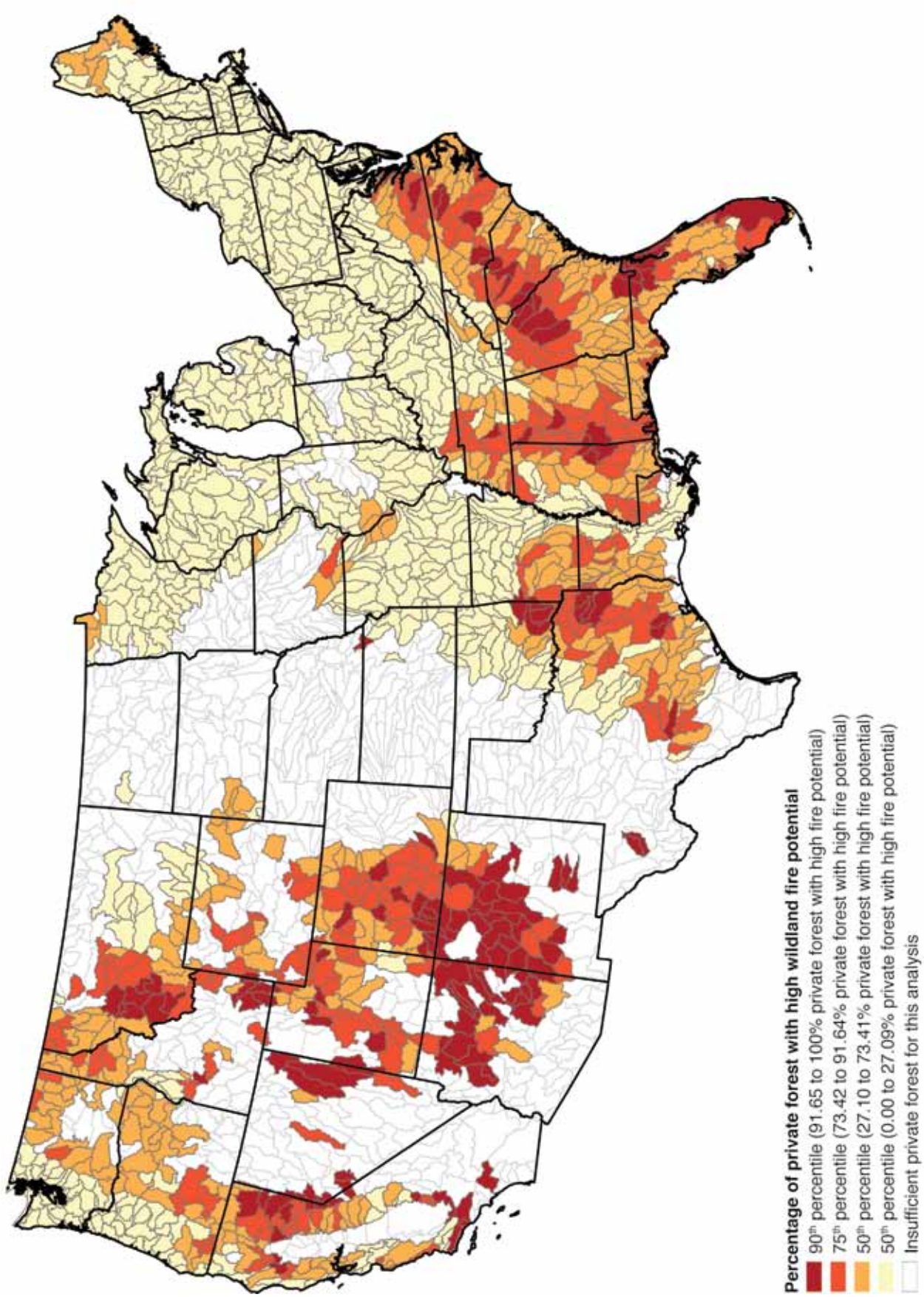

Figure 3.5—Watersheds by susceptibility and vulnerability of private forests to wildfire.