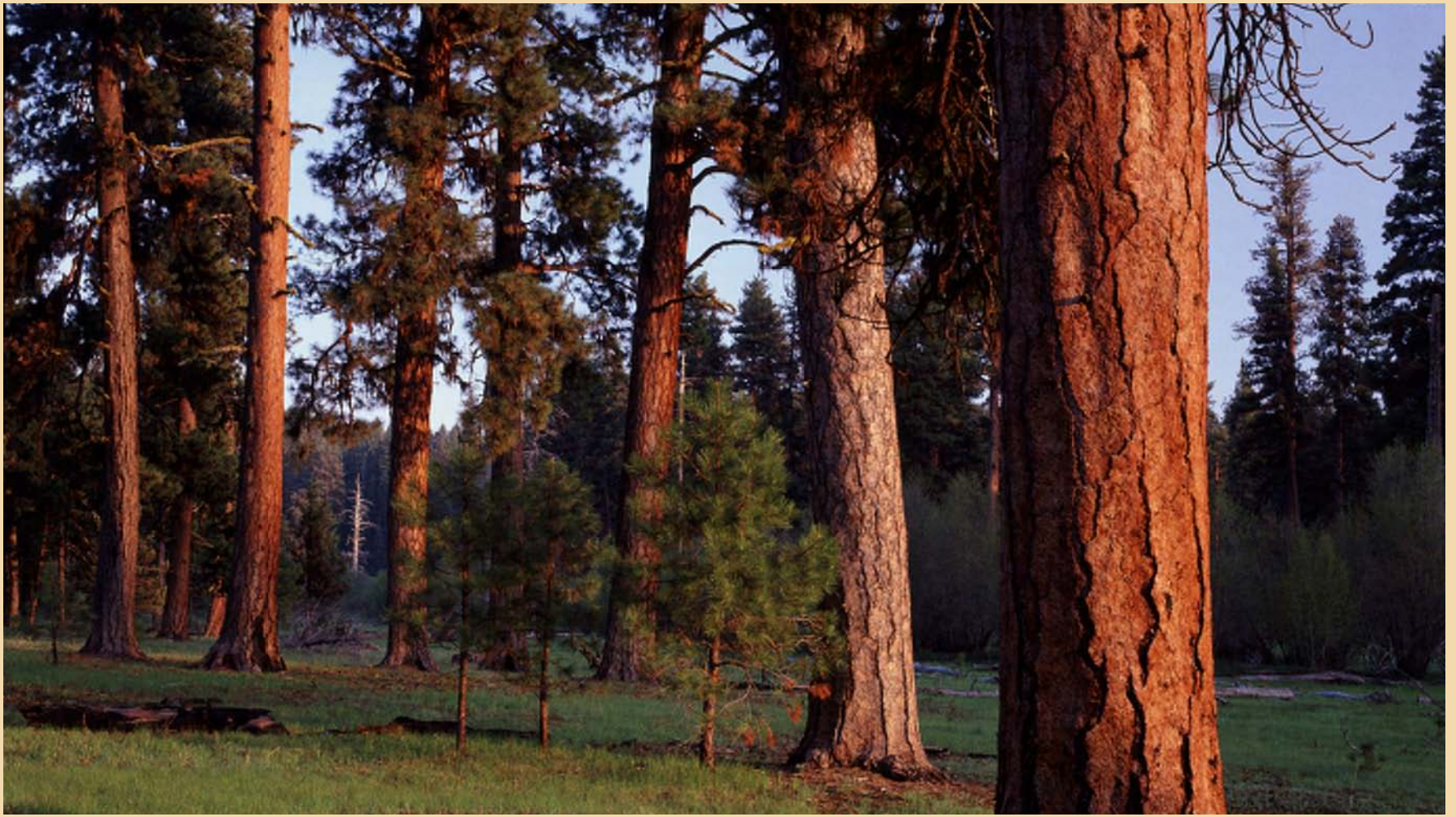
Ponderosa Pine in Peril:

Assessing Public Lands Livestock Grazing in Ponderosa Pine Forests



WildEarth Guardians
A FORCE FOR NATURE

A Report from WildEarth Guardians
By Kirsten Stade, MS and Mark Salvo, JD
August 2009

Mission Statement
WildEarth Guardians protects and restores the
wildlife, wild places and wild rivers of the American West.

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Executive Summary

The ponderosa pine (*Pinus ponderosa*) forest type covers nearly 34 million acres in the western United States and is believed to be in significantly degraded condition across much of this extent. Most ponderosa pine was historically maintained by low-intensity, high-frequency fire as open-canopied forests of diverse age structure. However, many of these forests today have been transformed into dense, even-aged thickets of young trees that are prone to high-intensity fire. While climate and weather may be the most important determinants of fire behavior in ponderosa pine, fire suppression and domestic livestock grazing are also considered important factors. The U.S. Forest Service and Bureau of Land Management (BLM), responsible for managing nearly 19 million acres of ponderosa pine, continue to suppress fire and permit activities that degrade ponderosa pine forests. The potential effects of livestock grazing on the periodicity and intensity of fire as an ecological process, and consequently on the structure and composition of vegetation in fire-adapted landscapes, are well known. However, no study has attempted to ascertain the extent of this land use in publicly owned ponderosa pine forests. We used Geographic Information System data to map the occurrence of ponderosa pine in the western United States and the extent of ponderosa pine forests grazed by domestic livestock on Forest Service and BLM lands. Our results show that more than 80 percent of the ponderosa pine forests managed by the Forest Service and BLM are subject to livestock grazing, creating a high likelihood of conflicts with the agencies' stated goals of restoring natural fire regimes in western forests.

A combination of historic livestock grazing and fire suppression eliminated fire disturbance from much of Bandelier National Monument for more than 100 years. Ponderosa pine density increased in the absence of fire. The National Park Service sought to use prescribed fire to restore ponderosa pine in the Jemez Mountains in the monument in May 2000. The agency lost control of the fire when un-forecast high winds drove the fire into the forest canopy, out of the monument and across the Santa Fe National Forest, which was parched by drought and also crowded with dense thickets of trees. The high intensity Cerro Grande Fire affected 50,000 acres, burning most of that area, including more than 250 homes and facilities at the Los Alamos National Laboratory, ranking it the most destructive fire in New Mexico history. *(photo: Tom Ribe)*

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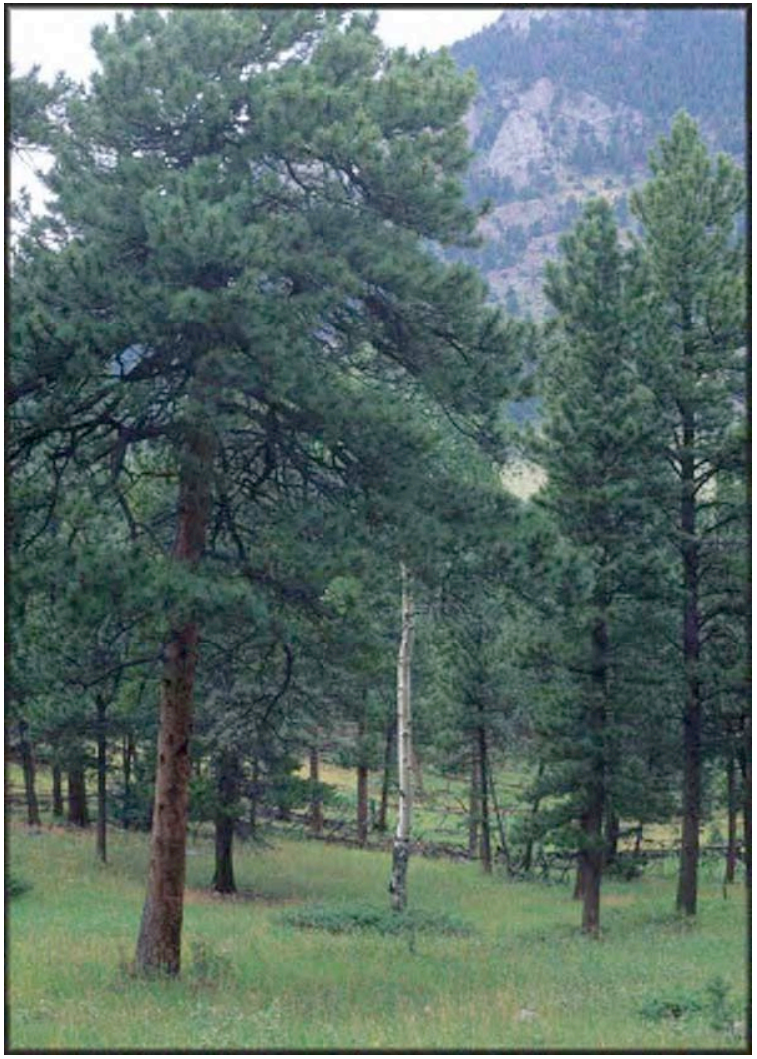
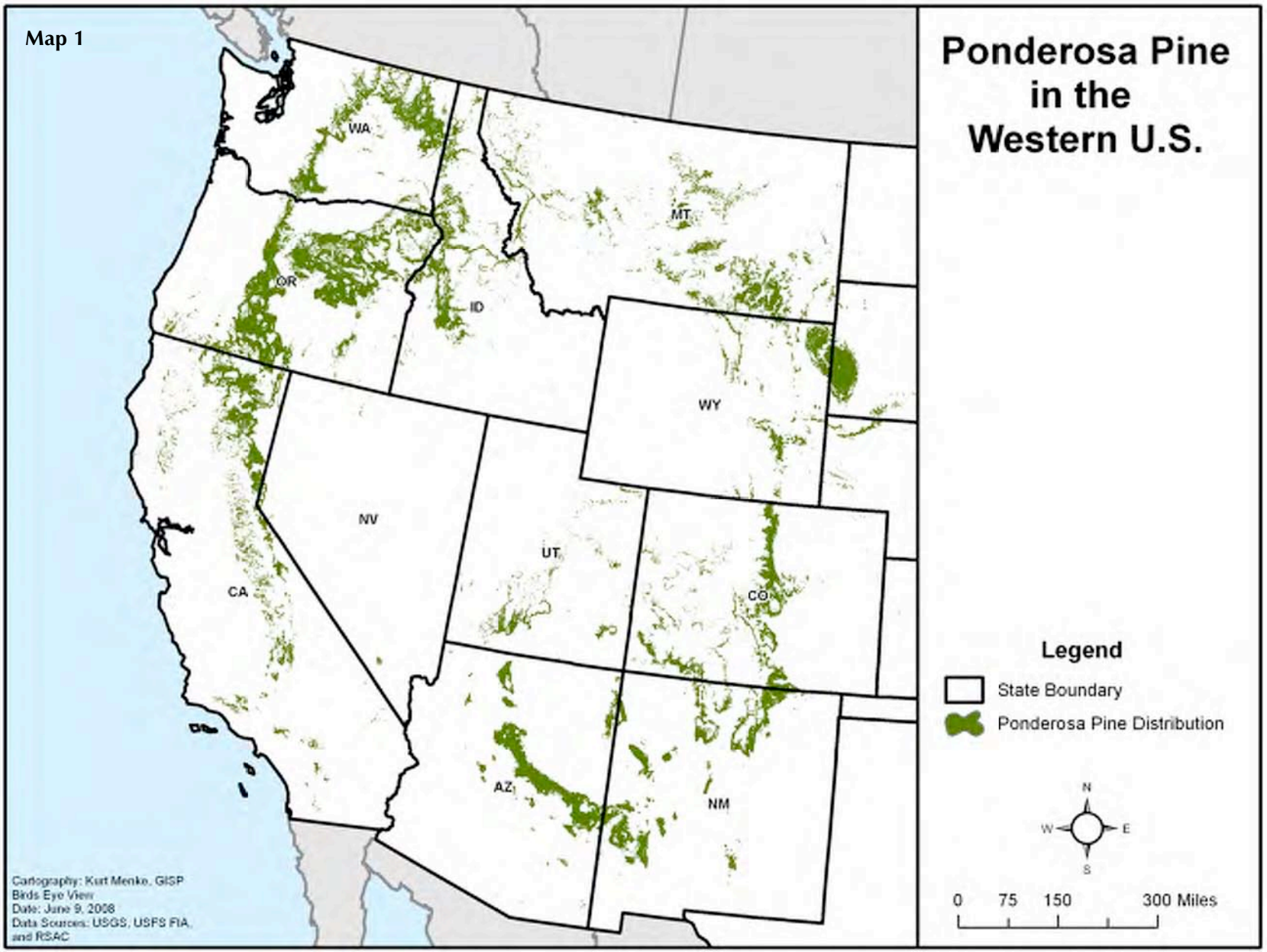
Livestock Grazing, Fire, and Ponderosa Pine Forest Structure

Many ponderosa pine forests in the western United States have undergone a dramatic change in structure and species composition since Euro-American settlement in the late nineteenth century. Throughout this ecosystem type, which occurs on semiarid lands between 6500 and 8500 feet elevation in the Interior West, open-canopied forests of large, widely-spaced trees have given way to dense thickets of small-diameter trees, with their formerly productive herbaceous understory now significantly diminished (Allen et al. 2002, Belsky and Blumenthal 1997, Cooper 1960, Covington and Moore 1994, Covington et al. 1997).

Historical reports and photographs (e.g., Beale 1858 *cited in* Cooper 1960), as well as contemporary dendrochronological analyses (Covington and Moore 1994, Mast et al. 1999), establish that many ponderosa pine forests once contained a diverse age structure of living and dead trees configured in open, park-like stands, with an understory comprised of perennial bunchgrasses, forbs, and shrubs (Fulé et al. 1997, Laughlin et al. 2004). The age structure was critical for a diverse assemblage of avian species that favor standing dead trees (snags) as nesting habitat (Mast et al. 1999). The open canopy and perennial grass understory provided habitat for a variety of small mammals that, in turn, were prey for predators such as the imperiled Northern Goshawk (*Accipiter gentiles*) (McKenzie et al. 2004). This climax state was historically maintained by low-intensity fire ignited by lightning and occasionally by Native Americans at varying intervals (Barrett et al. 2005, Belsky and Blumenthal 1997). The fire return interval was shortest (4-12 years) in the Southwest (Fulé et al. 1997, Belsky and Blumenthal 1997). The fire return interval may have been longer, and fire intensity more severe, in ponderosa pine forests (including mixed ponderosa pine forests) in northern latitudes and/or at higher elevations Hessburg et al. 2007, Baker et al. 2007, Cilimburg and Short 2005).



Park-like stand of ponderosa pine in Rocky Mountain National Park, Colorado. *(photo: George Wuerthner)*


Map 1
Ponderosa Pine in the Western U.S.
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Cartography: Kurt Menke, GISP
Birds Eye View
Date: June 9, 2008
Data Sources: USGS, USFS FIA, and RSAC

Settlement of the western United States, and the fire suppression, logging and livestock grazing that followed, have contributed to a dramatic transformation of many ponderosa pine forests. Livestock graze selectively on perennial grasses in pine forests, liberating pine seedlings from the effects of competitive exclusion. The removal of herbaceous vegetation also represents the loss of fine fuel that might otherwise carry high-frequency, low-intensity fire that naturally kills tree seedlings (Belsky and Blumenthal 1997, Covington et al. 1997). Fire is the primary control on tree seedlings in ponderosa pine, particularly in the Southwest (Covington et al. 1997) (although there are ponderosa pine stands where fire is infrequent, but where livestock grazing has never occurred, and the thick understory vegetation has apparently prevented seedling establishment and maintained open forest structure, *see, e.g.,* Madany and West (1983)).

Heavy livestock grazing in ponderosa pine in Malheaur National Forest, Oregon. Livestock have removed grasses and other vegetation (except inside the fenced grazing exclosure) that might have fueled occasional ground fire. Ponderosa pine seedlings establish easily in bare soil, for example, where livestock have removed competing vegetation. *(photo: Christopher Christie)*

Increasing density of young ponderosa pine in Coconino National Forest, Arizona. *(photo: George Wuerthner)*

Though seldom acknowledged by the agencies charged with managing ponderosa pine forests on public lands, the link between livestock grazing and the current "Forest Health Crisis" is well documented (*e.g.,* Belsky and Blumenthal 1997, Cooper 1960, Madany and West 1983, Savage and Swetnam 1990, Arnold 1950, Rummell 1951). Recent assessments have indicated a 25 percent increase in young trees (Dombeck 2004) and at least five-fold increases in tree density (Covington et al. 1997, Moore et al. 2004) in many ponderosa pine forests in the West—a change at least partly attributable to the widespread presence of domestic livestock on the landscape (Madany and West 1983). The increase in tree density at the expense of understory vegetation has increased the probability of high-intensity, stand-replacing crown fires in ponderosa pine (Mast et al. 1999, Madany and West 1983).

Federal Land Management Agencies and Fire

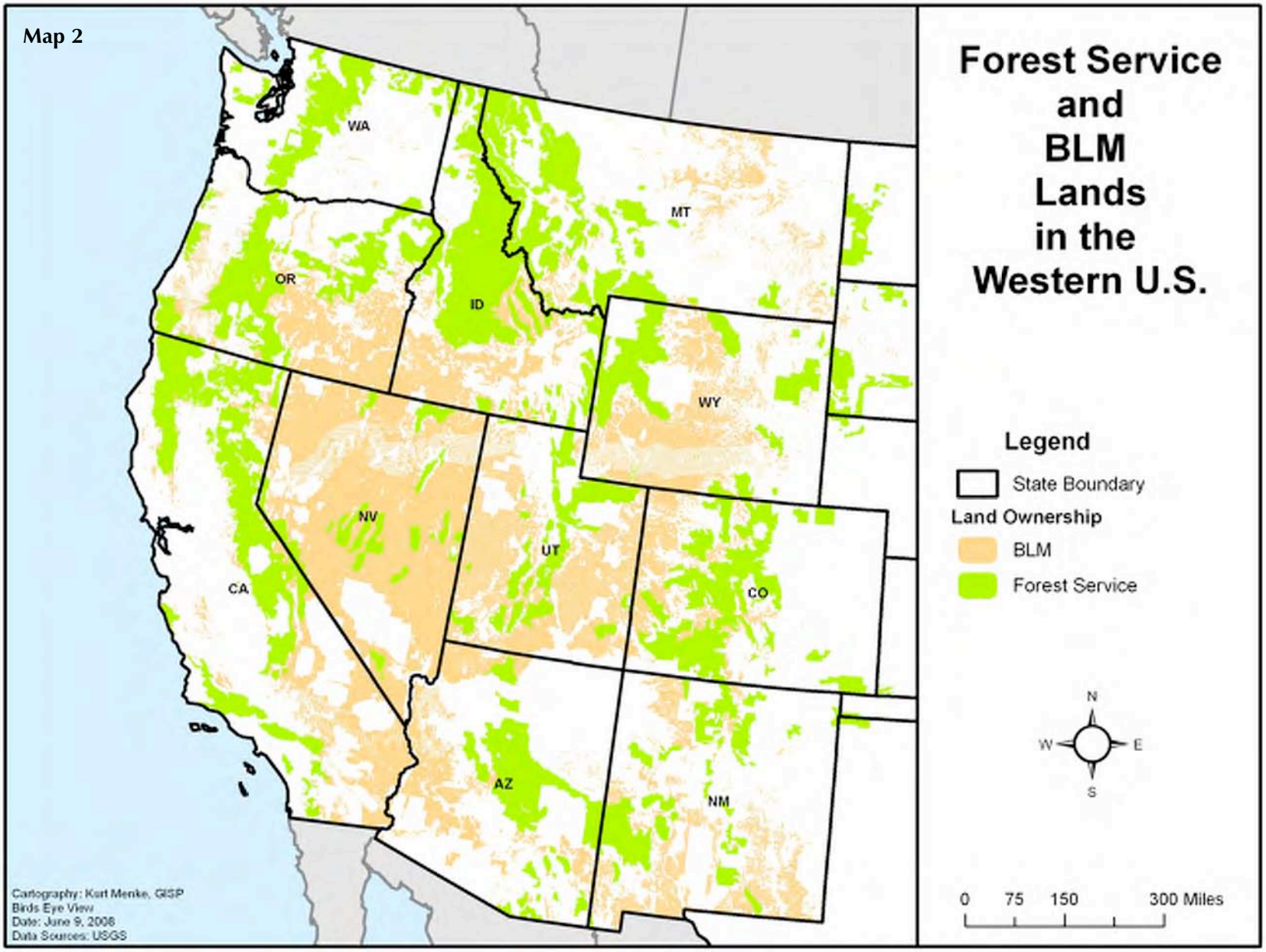
The low-intensity fire that nourished and sustained ecosystems adapted to its occurrence has only recently begun to reemerge from its century-long disappearance from American landscapes. United States public land management agencies have from their inception considered fire suppression a primary directive, and have aggressively fought fire at enormous taxpayer expense. Federal fire management activities—largely suppression—by agencies such as the Forest Service and the BLM cost taxpayers nearly $3 billion in fiscal year 2005 (GAO 2007), and likely considerably more in recent fire seasons.

This continued emphasis on suppression comes despite considerable evolution in federal fire policy over the past century, and improved institutional understanding of the ecological role of fire in recent decades. The Forest Service and BLM, which manage approximately 322 million acres of public land in the contiguous United States, have shifted over the past half-century from an exclusive focus on the production of commodities such as timber and beef to one that reflects to a greater degree their respective multiple use mandates. These agencies now ostensibly manage for wildlife, wilderness, and recreation in addition to agricultural commodities, and profess tolerance toward processes such as fire that enhance these values. Both the Forest Service and BLM have since 1995 expressed a commitment to use natural and prescribed fire to maintain fire-adapted ecosystems (NWCG 2001).

In fact, these agencies have implemented few of the fundamental changes in land use that will allow this new commitment to be realized, and the Forest Service admits that fire suppression remains prominent among its activities (USFS 2006). Although

Low intensity fire, carried by ground vegetation, kills ponderosa pine seedlings, reducing competition with and among older trees for water, sunlight and soil nutrients, and creating park-like stands favored by wildlife. *(photo: Tom Ribe)*

federal agencies have joined the broad scientific consensus that many ponderosa pine forests must be restored to reduce the risk of high severity fire and maintain critical habitat components (Allen et al. 2002), these agencies have also shown scant willingness to address the underlying causes of these forests' decline. Continued livestock grazing on federal lands obstructs management for a natural fire regime, as it alters a forest's ability to support low-intensity fire and increases the likelihood of unnaturally intense and large fire that the agencies often rush to suppress to protect property and human life.


Map 2
Forest Service and BLM Lands in the Western U.S.
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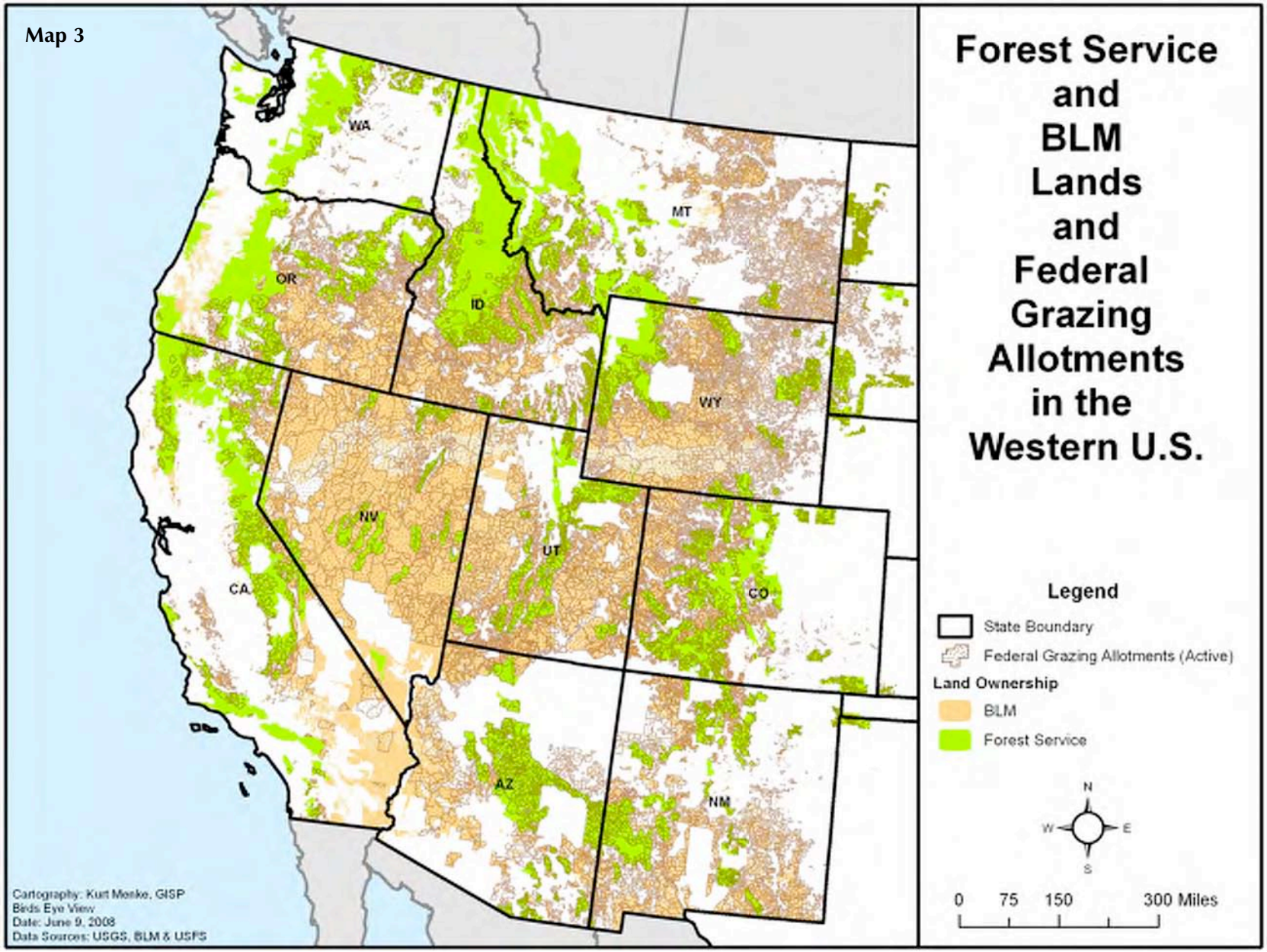
Birds Eye View
Date: June 9, 2008
Data Sources: USGS

Federal Public Lands Livestock Grazing

The Forest Service and BLM permit approximately 23,000 ranchers to graze approximately 231 million acres of federal public land in the United States (GAO 2005). Grazing occurs at a loss of at least $115 million annually to taxpayers (GAO 2005) and causes enormous damage to wildlife, watersheds, and natural fire regimes on millions of acres of grasslands, deserts, and forests in the United States.

Livestock grazing has occurred on public lands and in ponderosa pine for more than 150 years. Sheep grazing in ponderosa pine near Flagstaff, Arizona, in 1899. *(photo: F.H. Maude, Cline Library Special Collections, Northern Arizona University)*

The Government Accountability Office (2005) has noted that a primary purpose of the Forest Service and BLM grazing programs is to sustain public lands ranching; hence these federal agencies often permit grazing in areas that are unsuitable for this purpose. Livestock have been a critical factor in the transformation of ponderosa pine forests from the park-like conditions described by early observers to the dense, fire-prone thickets observed today (Allen 2002). Grazing also contributes to the spread of cheatgrass (*Bromus tectorum*), a highly flammable exotic annual grass that is encroaching into some ponderosa pine forests (C. Allen, pers. comm.). Given the role of grazing in altering the natural fire regime, and the importance of high-frequency, low- and mixed-intensity fire in maintaining the habitat conditions required by a number of species of concern, changes in management are required to reduce the predominance of this land use across ponderosa pine ecosystems.


Map 3
Forest Service and BLM Lands and Federal Grazing Allotments in the Western U.S.
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Cartography: Kurt Menke, GISP
Birds Eye View
Date: June 9, 2008
Data Sources: USGS, BLM & USFS

Geographic Information System Data and Analysis

We used Geographic Information System (GIS) data to determine the extent of ponderosa pine forests in the western United States, and what proportion are subject to grazing on Forest Service and BLM grazing allotments. GIS data for the occurrence of ponderosa pine was obtained from the Forest Service Remote Sensing Applications Center (RSAC), and extracted as a class from an RSAC dataset portraying 141 forest types across the contiguous United States (USDA 2004). Forest types were derived from Moderate Resolution Imaging Spectroradiometer (MODIS) composite images from the 2002 and 2003 growing seasons; this type of composite imagery improves on previous land cover classifications by eliminating cloud cover. The dataset has a resolution of 250 m and provides the most recent composite land cover data available for the United States. The original dataset was in image format and was converted to raster format for GIS analysis.

Vector datasets depicting boundaries of Forest Service and BLM lands were obtained from the agencies' respective websites (USFS 2007a, BLM 2007). We also obtained grazing allotment datasets from the agencies and their websites, and updated their current status using the most recent data on grazing activity available. Data were current as of 2004 as to the presence or absence of livestock on a given allotment. Although grazing use on allotments is often adjusted annually based on drought, economic conditions, and other factors, the data provide an adequate sense of the current overall use of public lands for livestock grazing. The allotment dataset was converted to a spreadsheet with primary key fields that allowed for linking non-spatial information pertaining to allotment status with spatial data representing Forest Service and BLM allotment boundaries.

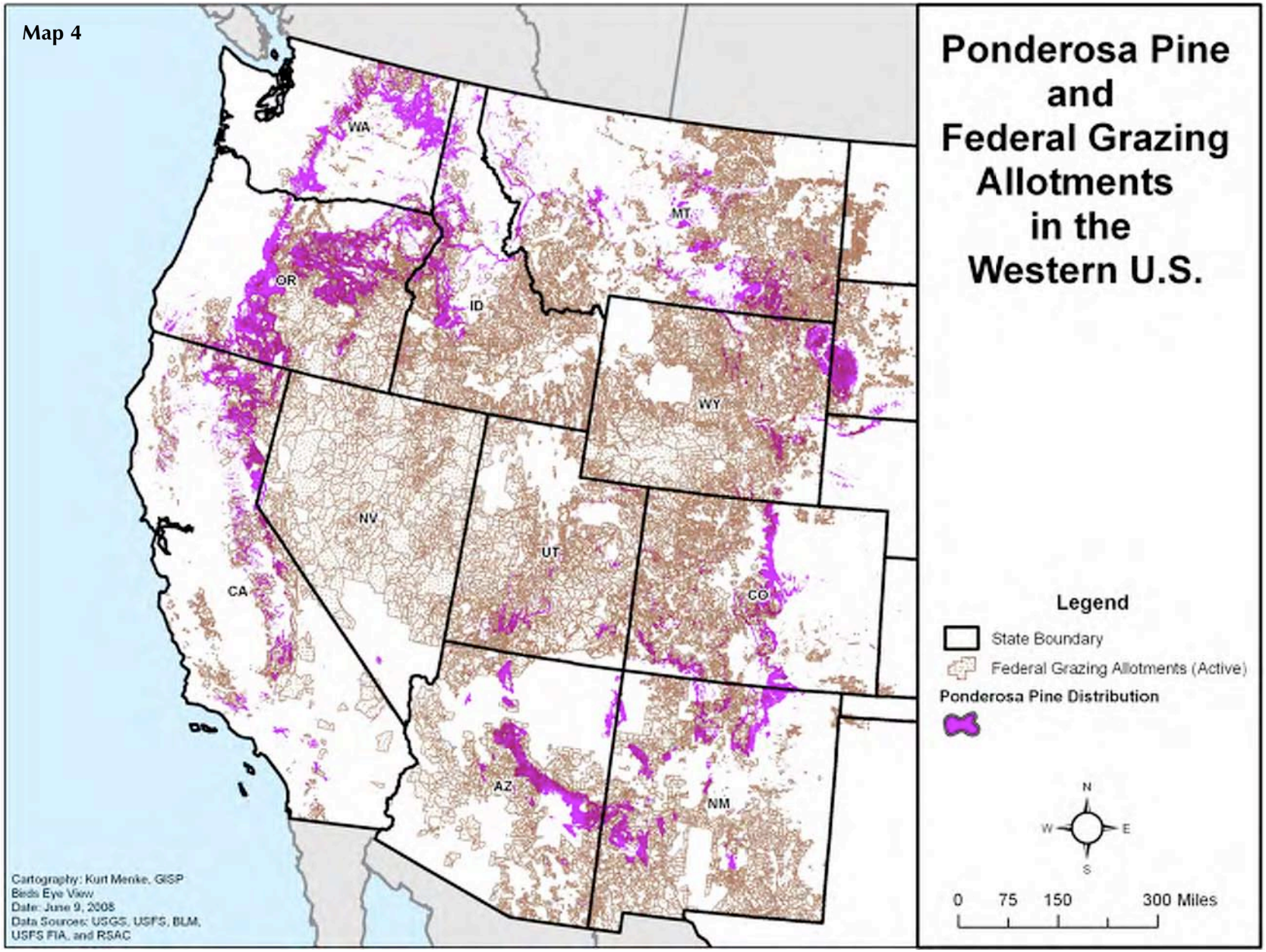
The GIS analysis performed was based on the technique known as zonal statistics, which was designed for the integrative analysis of raster and vector data. The primary results of this technique are counts of pixels comprising raster data and their statistical criteria (ArcGIS Desktop Help 9.1, 2007). In this study, the ponderosa pine forest-type were raster data and the Forest Service and BLM allotment boundaries were vector data. Ponderosa pine distribution was calculated for each of these datasets and then summarized for the total areas within Forest Service and BLM jurisdictions and also for allotments in active use status.

Livestock Grazing in Ponderosa Pine on Federal Public Lands

Of the estimated 34 million acres of ponderosa pine forests in the West, we found that nearly 16 million of the 19 million acres of ponderosa pine managed by the Forest Service and BLM are on active grazing allotments (Table 1). This represents 84 percent of all ponderosa pine forests on federal public lands. In fourteen western states that contain ponderosa pine forests, between 67 and 96 percent of these forests on public lands are grazed by livestock.

Table 1. Livestock Grazing in Ponderosa Pine Forests on Federal Public Lands

State	Ponderosa Pine Managed by Forest Service and BLM (acres)	Ponderosa Pine on Grazing Allotments Managed by Forest Service and BLM (acres)	Percentage of Ponderosa Pine Managed by Forest Service and BLM on Grazing Allotments
Arizona	3,231,022.38	2,792,211.44	86%
California	1,024,263.19	885,510.81	86%
Colorado	1,626,587.94	1,083,558.00	67%
Idaho	824,964.88	568,470.88	69%
Montana	1,009,148.94	838,580.56	83%
Nebraska	34,610.88	31,353.56	91%
Nevada	1,558.75	1,311.75	84%
New Mexico	2,538,665.63	2,022,544.38	80%
North Dakota	1,574.63	1,512.88	96%
Oregon	5,480,543.75	4,934,149.56	90%
South Dakota	1,413,704.50	1,301,242.31	92%
Utah	572,607.75	461,612.56	81%
Washington	246,922.38	183,103.88	74%
Wyoming	736,770.56	579,940.94	79%
Total	**18,742,946.13**	**15,685,103.50**	**84%**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Ponderosa Pine Distribution
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Cartography: Kurt Menke, GISP
Birds Eye View
Date: June 9, 2008
Data Sources: USGS, USFS, BLM, USFS FIA, and RSAC

Species of Concern Associated with Ponderosa Pine Forests

In addition to posing increased risks to firefighters and human communities, severe fire in human-manipulated ponderosa pine forests degrades habitat for wildlife dependent on old-growth or multi-aged, open canopy forests. Large, hot fires that burn into the forest canopy can destroy live trees and snags used by a variety of species for nesting, roosting and foraging. Among these, three birds, a bat and a squirrel are useful indicator species for understanding the importance of healthy ponderosa pine forests in the West.

The **Flammulated Owl** (*Otus flammeolus)* is a secretive, inconspicuous owl associated with open, mature montane forests, primarily ponderosa pine. The species selects forest stands with large trees and snags for nesting and adjacent openings for foraging (McCallum 1994). Thickets of denser foliage also appear to be a necessary habitat component, and are used for calling and roosting (McCallum and Gehlback 1988). The owl nests in cavities excavated by woodpeckers, including Northern Flicker, Acorn Woodpecker, Red-naped Sapsucker, and Williamson's Sapsucker (McCallum 1994).

The Flammulated Owl is insectivorous and forages by hovering and hawking, and thus requires a relatively open forest structure such as is associated with mature or old growth ponderosa pine habitat. The loss of mature, open forests is considered a contributing factor to the decline in Flammulated Owl populations. Audubon lists Flammulated Owl on its WatchList of vulnerable bird species and estimates its global population at 37,000 (Audubon 2007).

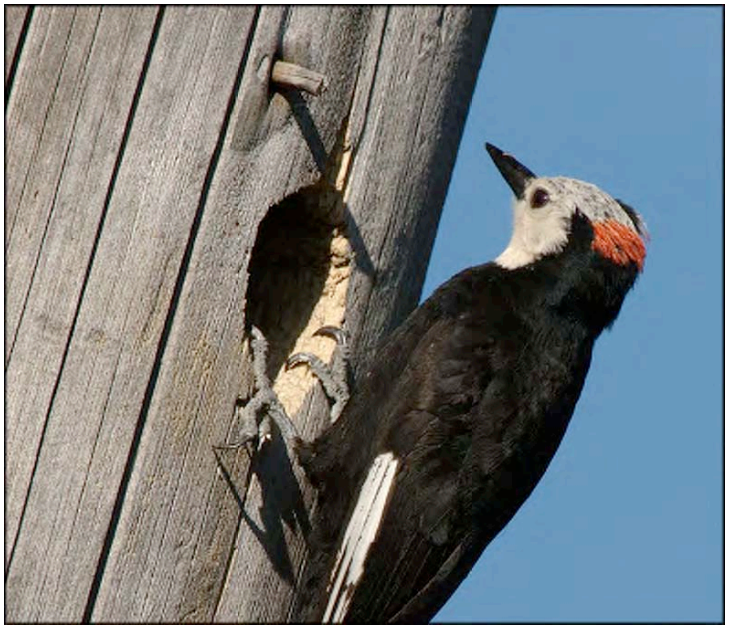
Flammulated Owl (male). *(photo: flicker.com/sugarbear96)*

The **Northern Goshawk** also depends on the structure and composition of healthy ponderosa pine forests. This species, identified as "sensitive" by the Forest Service in the southwestern United States, is believed to have declined in abundance due to habitat alterations caused by over a century of livestock grazing and fire suppression (Allen et al. 2002). The goshawk nests in open ponderosa pine forests dominated by large trees, which have all but disappeared in many forests where grazing and fire suppression have produced dense thickets of small-diameter trees. The generally closed canopies of these thickets also limit the herbaceous and shrubby understory that is important to the diverse prey species that sustain the goshawk, a problem compounded by continued livestock grazing that further constrains understory growth within ponderosa pine forests (Reynolds et al. 1992).

Northern Goshawk. *(photo: Karen Laubenstein, U.S. Fish and Wildlife Service)*

Long-legged Myotis. *(photo: Roger W. Barbour Collection, Special Collections & Archives, Morehead State University*

The **long-legged myotis** (*Myotis volans*) is a widely distributed, though vulnerable, bat species in North America. The myotis depends on forested habitats, usually at elevations of 4,000 to 9,000 feet. It feeds mostly on moths, emerging to feed in early evening and foraging over open water, meadows and forest clearings. The long-legged myotis will roost in crevices in the bark of both young and old ponderosa pine trees and snags (Herder and Jackson 2000; Baker and Lacki 2006), and in cavities excavated by other species (Herder and Jackson 2000 *citing others*). The BLM has designated the long-legged myotis as a "sensitive species" in Arizona, Montana, Nevada and New Mexico; the Northern Region of the Forest Service also lists the myotis as a "sensitive species."



White-headed Woodpecker (male). *(photo: flickr.com/Passerine)*

The **White-headed Woodpecker** (*Picoides albolarvaus*) is highly dependent on open-canopied, multi-aged and old growth ponderosa pine forests for nesting and food. They use large, decayed snags for nesting and roosting and forage in the bark of large ponderosa pine trees (Raphael and White 1984, Garrett et al. 1996). The woodpecker prefers to forage for insects on the scaly bark of live trees (Raphael and White 1984, Morrison et al. 1987), and they feed heavily on seeds from unopened pine cones during winter (Ligon 1973, Garrett et al. 1996). Fire suppression or a lack of fire results in a closed forest canopy and less suitable habitat for the species.

The Forest Service lists White-headed Woodpecker as a "sensitive species" in the Northern and the Intermountain regions, and Washington has identified the woodpecker as a candidate for addition to the state endangered, threatened and sensitive species list. Audubon lists the woodpecker on its WatchList and estimates its total population at 72,000 (Audubon 2007).

Abert's squirrel (or tassel-eared squirrel [*Sciurus aberti*]) occurs in dry, mountainous, coniferous forests in the southern Rocky Mountains and the Southwest. The squirrel favors ponderosa pine forests. They use ponderosa pine seeds for food and use the trees as nesting sites and for shelter. Abert's squirrel are prey for the Northern Goshawk.

Abert's squirrel. *(photo: Sally King, National Park Service)*

Conclusion

The Forest Service and BLM have historically ignored their multiple use mandate to manage public lands in favor of agricultural commodity production, including livestock grazing. Although climate and weather may be the primary drivers of wildfire in ponderosa pine forests, those degraded by livestock grazing are less resilient and less likely to respond naturally to fire. Grazing should be restricted in publicly owned ponderosa pine forests to restore ecological processes that stimulate understory growth, maintain hydrological function, facilitate proper cycling of nutrients and organic matter, and support low-intensity fire.

Nearly half of all ponderosa pine forests in the West and 84 percent of those on public land are open to public lands grazing. This management practice has severe consequences for these forests and the fish and wildlife that depend on them. We recommend restricting livestock grazing in degraded forests, especially after fire, to allow understory vegetation to reestablish so that it can support low-intensity fire again. We further recommend that the U.S. Congress create a voluntary grazing permit retirement program to allow for the permanent removal of livestock from ponderosa pine forests and other landscapes. Removing livestock from ponderosa pine forests is an important step to restoring and maintaining natural fire regimes to this ecosystem.

This ponderosa pine forest on Escobas Mesa in Bandelier National Monument has been treated with prescribed fire twice since 1980. Much of the Escobas Mesa also burned in the 1977 La Mesa Wildfire. That fire crowned over much of the mesa and elsewhere in the monument, but spared this island of trees, where the fire apparently remained on the ground. *(photo: Tom Ribe)*

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