

The original table with metric values and the original color figures have been appended to the end of this document.

**Correction:**

An error was introduced into the text at some point during production. The bottom of p. 69 states “May 1903 was extremely dry; with less than two inches of precipitation, it is the driest May and third driest month ever recorded (1893-1997) at Bethlehem, New Hampshire.”

The correct precipitation for May 1903 is 0.75 cm (0.3 inches).

# Fire in the White Mountains

## A Historical Perspective

Christine L. Goodale

**T**he White Mountain National Forest (WMNF) owes its existence, in part, to its fiery history. In the late 1800s and early 1900s, debris from unprecedented logging fueled fires across the region. This disruption inflamed public ire, and concern over the potential loss of these beloved forests—and, influentially, concern by downstream manufacturers that deforestation would dry up their river power—eventually brought about the Weeks Act in 1911. The Weeks Act authorized the federal purchase of forestland and established the WMNF.

The public outrage at logging-era fires contrasts with public appreciation of the scenic side effects of some fires long past: enhanced views of and from such peaks as Chocorua, Crawford, Moat, Welch, Hale, the Sugarloaves, and the Baldfaces. On these and other mountains, forest fires cleared the low summits of view-blocking trees, and subsequent erosion washed away much of the soil that might have supported regrowth. Elsewhere, picturesque stands of paper birch owe their origin to fires from a century ago.

Detailed information on the location of old White Mountain fires is now available through a newly compiled and digitized set of maps drawn originally between 1911 and 1937 in response to the

Weeks Act. Prior to purchasing land to form the WMNF, the federal government sent out forest examiners to determine land value. Examiners surveyed and mapped each prospective tract. Nearly sixty of these large canvas (figure 1) or paper maps have survived at the WMNF headquarters in Laconia, New Hampshire, and have now been digitized. Together, these maps provide information on the extent of fires and other disturbances across 590,000 acres, or 80 percent, of the current WMNF in New Hampshire.

The areas of old fires were taken from the digitized examiners' maps, where patches were mapped as either "burned" or "second growth" following older fires. Accompanying surveyors' reports and period state forestry reports, newspapers, and guidebooks provided additional information on the dates, severity, and circumstances of



Figure 1: The 1911 survey of the Wild River Valley, then owned by Hastings Lumber Company and F. H. Wheeler, displayed by Susan Cone of the White Mountain National Forest headquarters in Laconia, NH. *Photo courtesy of the White Mountain National Forest.*

these fires. One report of particular note is that of Alfred K. Chittenden. Early in 1903, with concerns mounting over the condition of New Hampshire forests, the state legislature requested a federal assessment of the state's forests. The timing of this request was fortuitous, as record-setting fires struck the White Mountains later that spring, and Chittenden surveyed the region weeks later. His assessment was published as part of a state forestry report (Chittenden 1904) and later, with few changes, as a federal report (Chittenden 1905).

### A Brief Forest History

White Mountain forests consist largely of northern hardwoods below about 2,500 feet and spruce-fir forests above. Soils also vary with elevation, from glacial tills with forest floors of moderate depth, to high-elevation organic mats over bedrock. Cold, wet conditions and poor decomposability of spruce and fir needles allow a thick organic layer to accumulate. This climate usually inhibits fire, but these soils can burn if they dry out in hot, droughty weather, leaving little organic soil behind.

Fires were quite rare prior to the logging era (Spear et al. 1994). Records from early surveys of northern New England suggest that fires might be expected to burn any particular area of forest approximately every 1,500 to 2,500 years (the "fire return time") (Lorimer 1977). Wind has been the dominant cause of tree mortality, ranging from single-tree windfalls to extensive blowdowns caused by the occasional hurricane, most notably in 1815 and 1938.

Settlers arrived in the mid-eighteenth century. They cleared small farms in the lowlands and often worked the woods in winter, using oxen or sometimes horses for selective harvest (Brown 1958). Harvest practices changed in the late nineteenth century, when demand, ownership patterns, and technological advances led to intensive logging of spruce forests. The state of New Hampshire owned large tracts of White Mountain forest through 1867, when it sold them to large timber and paper companies. Elsewhere, land speculators consolidated many of the small divided lots in the lowlands. On the technological front, the innovation of using wood pulp for paper (rather than rags or straw) greatly increased demand for softwoods, especially for trees too small to be valuable for timber. Furthermore, construction of first commercial and later logging railroads vastly enhanced opportunities for transporting timber from the forest. The

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commercial railroads also carried wealthy vacationers to the region's grand hotels, and the obvious extent of logging and fires caused great concern. The *Atlantic Monthly* published this account (Ward 1893):

Up to Whitefield and thence to Jefferson, you find that the entire stretch of lowland in this region has been despoiled of its forests. The Brown Lumber Company has cut off the trees as locusts in Egypt destroyed the blades of grass in the days of Pharaoh. There is nothing left. . . . The condition of the Zealand Valley is as striking an instance as can be named of unwise and barbarous lumbering in this region.

### White Mountain Forest Fires

Where, when, and why did forest fires occur? Information from the examiners' reports indicates that at least 21 percent of the WMNF (139,000 acres) burned during the century prior to purchase by the federal government. This total likely underestimates burned area, as some sites burned repeatedly but are counted only once; old fires were likely overlooked when the forest had regrown sufficiently; and, in a few cases, fires occurred after completion of the examiners' surveys. Old burns, between 1800 and 1880, covered 5 percent of the mapped area or at least 34,000 acres. This amounts to a burn rate of 0.06 percent per year, or a mean fire return time of 1,600 years—a very long time. As logging increased sharply between 1885 and 1925, burn rates increased sixfold to 0.4 percent per year (shortening the return time to 250 years) and covered 104,700 acres (see list on page 72). The largest of these fires are described below in chronological order.

### Early Fires (1800–1880)

These fires occurred largely near early settlements of Conway, Chatham, Warren, and Campton (figure 2). Few details are available on the circumstances that led to these fires, though several (Chocorua, Crawford, Sandwich Dome, and Cone Pond/Tecumseh) occurred around or shortly after 1815, a year when an intense hurricane struck the White Mountain region. Trees downed by this hurricane may have fueled subsequent fires started by lightning or nearby farmers.

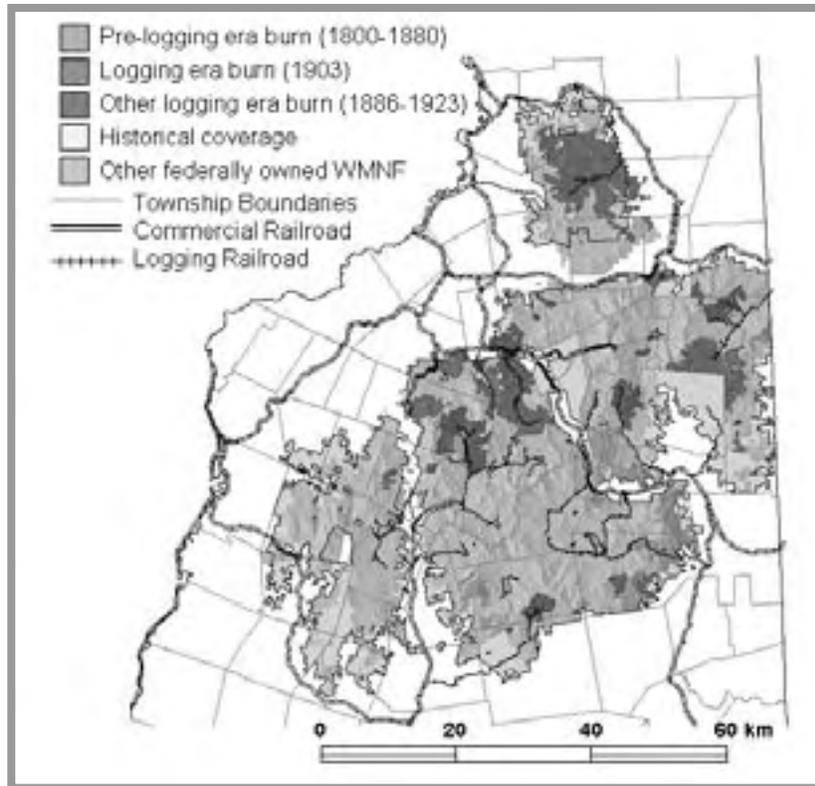


Figure 2: map of the nineteenth and early twentieth century fires within the White Mountain National Forest. Railroad, township, and national forest boundaries from *N.H. Granit*; logging railroads taken from Belcher (1980). Map courtesy of Christine L. Goodale.

*Cold River* (c.1800). The least well defined of the early White Mountain fires is one on the eastern edge of the WMNF. In describing the tract, the forest examiner (Woodward 1911) reported that:

Prior to 1880, the most important event in the history of this tract was a fire which occurred about 1800 and denuded approximately 10 per cent of the total area. . . . The greater part of the Cold River logging unit was burned over about one hundred years ago [i.e., c. 1811], and there is very little large merchantable timber left.

Ten percent of this tract amounts to 3,700 acres. This old burn does not appear on the examiner's map, but small areas near Basin Brook were mapped as second growth, and nearby areas on Mounts Royce and Meader were mapped as "subalpine," despite their low elevation. This fire may have also swept south along the ridge to consume the low, rocky summits of North and South Baldface. Early trail guides indicate that these peaks had acquired their distinctive names by the mid-1800s and were favorites of late nineteenth century berry-pickers (Sweetser 1876), strongly indicating an earlier fire. They burned again in 1903.

*Chocorua (c.1815)*. Past *Appalachia* historians (Comey 1940, Fobes 1953) suggest that Mount Chocorua first burned "about 1815" in a fire that extended from the south flank to the summit. The forest examiner for this tract (Davis c. 1920) noted a similar date:

... the second growth is the result of an old burn which occurred about 100 years ago [i.e., c. 1820]. The timber consists principally of white birch with a scattering of other hardwoods. ... The subalpine is the result of the old burn 100 years ago cleaning off all of the good soil, more than the elevation.

Later fires burned over much of the same area, making the full extent of this old fire difficult to distinguish. As described by the New Hampshire Forestry Commission (1902, p. 80):

The absolute nudity of the summit of Mount Chocorua. . . is a striking instance of what a succession of forest fires will accomplish. That bald, naked, glistening, and serrated cone, so absolutely distinguishable among all New Hampshire's summits, is much below the normal timber level in its altitude, and yet the growth with which it was once covered has been entirely removed by the flames, and the soil upon which it stood has also gone, leaving to nature the slow work of again creating the conditions for forest growth. . . .

*Crawford/Resolution (c. 1815)*. On surveying this tract, the forest examiner (Martin c. 1913) observed that:

Subsequent to the settlement of the Saco Valley, a large part of this area has been burned over. These fires occurred from 60 to 100 years ago [i.e., c. 1815–1855] so that at the present time the land is all completely restocked by tree growth. . . . The hardwoods are principally paper birch.

Few other details are available, except for a trail description of Mount Crawford which stated that “the mountain was burnt over about the year 1815, and even the soil was destroyed” (Sweetser 1876, p. 139).

*Cone Pond/Tecumseh* (c. 1820). The examiner of the tract on the southwest side of Tecumseh (Hall 1917) described the second-growth spruce as “. . . probably the result of a very extensive burn which occurred 70 to 80 years ago” [i.e., c. 1837–1847]. The examiner of the adjacent Waterville Valley tract (Anonymous 1912) suggested an earlier date: “A large portion of this area on both sides of the [Mad] river is a second growth following a fire which occurred in 1813.” Extensive work with tree cores from Cone Mountain to Mount Tecumseh indicate a burn date of 1820; that is, several years after the 1815 hurricane (Buso et al. 1984, Hornbeck et al. 1997, D. Buso pers. comm.). Local historians report that massive landslides following floods in 1826 cleared the slopes of nearby Welch Mountain (Bean 1983, p. 207). The complete loss of forest and soil at this site may have resulted from a sequence of catastrophic events: The 1815 hurricane downed timber that dried and burned in 1820 (Hornbeck et al. 1997), and this burned land would have been particularly vulnerable to erosion in floods of August 1826 (described in Crawford 1846).

*Sandwich Dome* (c. 1820). The examiner of a tract northwest of Black Mountain and Sandwich Dome described second-growth spruce and birch-poplar forest as the “results of old fires that occurred 40–50 years ago” [i.e., 1869–1879] (Hall et al. 1919). Period hiking guides described “thickets and stony lands” (Sweetser 1876, 1898) along the summit but make no mention of recently burned forest, indicating perhaps a considerably earlier fire. Tree cores and charcoal from near Black Mountain Pond, just south of this mapped tract, indicate an intense burn about 1820 (Buso et al. 1984, D. Buso pers. comm.).

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*Moat Mountain (1854)*. Hitchcock's geologic survey of New Hampshire (1874, p. 196) reported that "the Mote [sic] mountains have been burnt over, so that they appear unusually barren when seen from a distance." Similarly, a period guidebook (Sweetser 1876, p. 87) noted that Moat "has been burnt over several times, and even the soil has thus been destroyed," while another (Sweetser 1898) indicated it "burnt over in the year of the Crimean War," or 1854. This date is corroborated by the examiner's survey for this tract (Martin 1914b), which described the area around Moat Mountain as second growth after a fire around 60 years earlier [i.e., 1854].

*Other Early Fires*. Anecdotal records indicate that several other fires occurred in the White Mountain region before 1880. However, these fires either occurred outside of what is now the WMNF—for example, Percy Peaks or Mount Hayes—or did not appear in the database due to missing historical information. Hitchcock (1874, p. 584) describes evidence of a fire visible from the Cog Railway from perhaps 1830 in the Ammonoosuc Valley, and others suggest a small fire on Mount Whiteface. A history of the town of Warren, New Hampshire (Little 1870, p. 471), describes several fires but details only one:

It was in the summer of 1854 that the fire roared on Mount Carr. Then a million trees burned to the wind. Then a sound came like the rushing of the tempest; like the mighty voice of the ocean. Its roaring was heard six miles away, and one could see to read fine print at midnight.

Unfortunately no examiners' surveys could be found for the Mount Carr region.

### Logging Era Fires (1880–1925)

Essentially all of these fires resulted, directly or indirectly, from logging activities. In some areas, logging railroads sparked flammable material; in others, fuel loads from past logging (branches, tops) enabled lightning strikes to spread.

*Zealand Valley (1886)*. The first fire in the Zealand Valley was likely ignited by a spark from a logging railroad (Belcher 1980, p. 100).

This fire consumed recently logged land and spread to unlogged forest. The New Hampshire Forestry Commission (1902, p. 79) and Chittenden (1904, p. 78) mistakenly report the date of this fire as 1888, and many later accounts perpetuate this error (Kilbourne 1916, Hale 1958). Using period newspaper references, Belcher (1980, p. 99–101) verified the date of 1886.

Regardless of its exact date, the Zealand Valley fire gained particular notoriety because its effects were both markedly severe (figure 3) and visible to tourists passing through en route to hotels at the base of Mount Washington. For example, in an address to the American Forestry Association Joseph B. Walker proclaimed:

Some twenty years ago, more or less, the lumberman, invading that part of the Ammonoosuc valley between Twin Mountain House and Fabyan's, swept away the forests which had made it one of the most pleasing localities in the mountains. . . .



Figure 3: Summit of Mount Sugarloaf with Mount Hale at upper right, photographed in 1903. From Chittenden, 1904, and courtesy of the Maine Special Collections and Archives Department, University of New Hampshire Library, Durham, New Hampshire.

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Ere long fire followed in the footsteps of the lumberman, and swept away in its fury whatever he had spared. An abomination of desolation, as lugubrious as that spoken of by Daniel the prophet, succeeded the fire.

This great tract of charred soil, dotted all over with blackened stumps, lying as it did along the main highway from Bethlehem to the Crawford House, arrested the attention of every visitor. Universal regret, with much indignation, was freely expressed on account of the great injury thus done to one of the finest portions of the whole mountain region. Public opinion was aroused to activity. (Walker 1894, p. 102–103)

This fire and continued logging elsewhere spurred early action to establish the White Mountains as a public park, or at least to regulate forest practices and fire safety.

*Cherry Mill Brook* (date unknown, c. 1890). Several burned patches appear near Cherry Mill Brook on the north slopes of the Dartmouth Range. Chittenden (1904) mapped these patches as “old burn” and reported (p. 47) that “severe fires have occurred on the slopes of Cherry Mountain and the Dartmouth Range, and on these old burns the growth is very poor.”

*Moriah Brook* (c. 1895). A large fire struck the Moriah and Bull Brook valleys within the Wild River drainage, although the date of this fire is uncertain. Belcher (1980) lists 1885, or five years before construction of a logging railroad that later reached both brook valleys. The forest examiner for this tract reported a large fire in the 1890s (Woodward 1911), and Wight (1971, p. 99) suggests 1895. The last date appears most consistent with dates of logging.

*The 1903 Fires*. One year, 1903, accounted for two-thirds of the total area burned in the WMNF during the logging era, and its three largest fires: 1) the Kilkenny/Berlin fire; 2) the second Zealand Valley fire; and, 3) the Wild River fire. May 1903 was extremely dry; with less than two inches of precipitation, it is the driest May and third-driest month ever recorded (1893–1997) at Bethlehem, New Hampshire. Fires started in May and June, particularly in logged areas. The

Kilkenny and Wild River fires effectively ended intensive logging in these regions, whereas logging in the Zealand Valley had ended a decade earlier. The 1886 and 1903 fires in the Zealand Valley were largely separate areas but did partly overlap (Chittenden 1904, p. 82). Logging slash left behind in all three areas likely fueled these fires.

Other regions burned in 1903 include the north slopes of Mount Lafayette (Jordan Brook) and the Twin range (Gale River), as well as Pine Mountain near Gorham and Mount Chocorua. Chittenden (1904, p. 74) noted that Pine Mountain had burned repeatedly, and Fobes (1953) suggested that it first burned in 1897. Chittenden mapped a large burned area southeast of Mount Chocorua, although neither Chittenden nor the examiner's survey distinguished between the 1815 and 1903 burns.

In total, Chittenden mapped 84,255 acres of burn from 1903 fires across northern New Hampshire, of which 78,375 acres were in the White Mountain region (Chittenden 1904, p. 20).

*Owls Head (1907)*. Four large fires occurred after 1903. The first was the Owls Head fire in the Pemigewasset Wilderness, which was started by lightning on August 17, 1907, in an area logged between 1900 and 1903 by J. E. Henry & Sons. Some report this date as 1908, but period accounts firmly establish the fire as 1907 (New Hampshire Forestry Commission 1908; Perkins 1908; Belcher 1980, p. 136–140). Others listed the correct date but overestimated its area by at least threefold (Kilbourne 1916, p. 382).

*Rocky Branch (1912–1914)*. A series of fires occurred during 1912–1914 in the Rocky Branch valley south of Mount Washington. An examiner's report from late 1913 (Martin c. 1913) indicated that logging had been heavy over the previous eight years, and that 630 acres had burned in 1912 and 1913. With foresight, he warned, "The ground is at present covered with the recent slash, and is easily inflammable, so that the fire risk in this valley is very great." This land burned in June 1914 (Belcher 1980, p. 194), and a subsequent survey (Martin 1914a) increased the tract's burned area to 2,840 acres. Combined with burned areas on an adjacent tract, the Rocky Branch fires (4,862 acres) were among the largest in the White Mountains, although this estimate is far smaller than suggested by others (35,000 acres; Alexander 1978, Gove 2001).

*Chororua* (1915). In June 1915, a fire broke out between Mounts Paugus and Chorocua (Beals 1916) on land heavily logged in previous years (Davis c. 1920). As for the Rocky Branch region, a previous examination (Martin 1914c) warned of the dangers of fire on the cutover land. The map for this tract suggests the fire covered 1,422 acres, although the fire was likely larger by up to 50 percent. An anecdotal account (Beals 1916, pp. 135, 269) reported that the 1915 fire reached north of the area mapped, to Champney Falls. Beals (1916, p. 263–269) vividly describes another fire in 1912 in the valley west of the 1915 fire, but the tract map includes no indication of this fire.

*Flat Mountain* (1923). The last major fire in the White Mountains occurred in July 1923, along the line of the then-active Beebe River logging railroad, which likely caused the fire. This fire was highly visible to vacationers, and the tract owners were strongly reprimanded by the state forester, who by 1923 had been given power to regulate logging practices to reduce fire hazards (Belcher 1980, p. 231–234).

### Recent History

During the last forty years, only 643 cumulative acres of the WMNF have burned (Main & Haines 1974; T. Brady, USFS, pers. comm. June 2003). This amounts to just 0.002 percent of the forest per year. This reduction in fires is due largely to changes in forest harvest practices and to advances in fire detection and suppression. Unlike in the western U.S., where natural fires were common, fires in White Mountain forests were rare. However, they did occur under the right circumstances—when natural (hurricane) or human (heavy logging) factors disturbed large patches of forest, and these patches coincided with the right combination of weather and ignition sources. Concerted efforts helped prevent similar combustion after the 1938 hurricane (Hale 1958), and future fires are possible should the right combination of circumstances occur again. Furthermore, the unusual burst of flames in the early 1900s was very important for the formation of the national forest system and for determining many of the characteristics of White Mountain forests today.

ACKNOWLEDGMENTS. The work was started at the University of New Hampshire, where it was supported by the NASA Earth System Science Program. NASA grant #NAG5-3527 provided funding for

### Fires in the White Mountain National Forest

Date	Fire Name	Estimated Area (acres)
c. 1800?	Cold River	c. 3,700
c. 1815	Chocorua (1)	3,265
c. 1815–1855	Mount Crawford	8,647
c. 1820	Mount Tecumseh	3,658
c. 1820?	Sandwich Dome	> 2,151
c. 1850?	Bartlett	934
1854	Moat Mountain	11,794
1854	Mount Carr	?
1886	Zealand Valley (1)	7,265
c. 1890?	Cherry Mill Brook	1,149
c. 1895	Moriah, Bull Brook	4,111
1903	Zealand Valley (2)	14,375
1903	Gale River	3,043
1903	Jordan Brook	3,434
1903	Kilkenny/Berlin	30,963
1903	Wild River	12,314
1903	Mount Shaw	616
1903	Pine Mountain	1,890
1903	Lost River/Bog Pond	982
1903	Chocorua (2)	1,813
1905	Pinkham Notch	396
1907	Owls Head	10,610
1908	Flume Mountain	423
1911	Carter-Moriah Trail	833
1912–1914	Rocky Branch	4,862
1915	Chocorua (3)	> 1,422
1923	Flat Mountain	3,152
Sum of other small fires		1,144
Subtotal 1800–1880		34,254
Subtotal 1903 alone		69,430
Subtotal 1886–1923		104,697
Total All Fires		138,951

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digitizing the maps, and Robert Damm oversaw the effort by many patient people at N.H. GRANIT. Don Buso and Charlie Cogbill generously provided information and insights. Assistance from WMNF staff, including Sue Cone, Karl Roenke, Norma Sorgman, Dave Govatski, and particularly Steve Fay was essential to the completion of this project.

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Table 1: Fires on the White Mountain National Forest.

Date	Fire Name	Estimated Area	
		(ha)	(acres)
c. 1800?	Cold River	c. 1,500	c. 3,700
c. 1815	Chocorua (1)	1,322	3,265
c. 1815-1855	Mt. Crawford	3,501	8,647
c. 1820	Mt. Tecumseh	1,481	3,658
c. 1820?	Sandwich Dome	> 871	> 2,151
c. 1850?	Bartlett	378	934
1854	Moat Mountain	4,775	11,794
1854	Mt. Carr	?	?
1886	Zealand Valley (1)	2,941	7,265
c. 1890?	Cherry Mill Brook	465	1,149
c. 1895	Moriah, Bull Brook	1,664	4,111
1903	Zealand Valley (2)	5,820	14,375
1903	Gale River	1,232	3,043
1903	Jordan Brook	1,390	3,434
1903	Kilkenny/Berlin	12,536	30,963
1903	Wild River	4,985	12,314
1903	Mt. Shaw	249	616
1903	Pine Mtn.	765	1,890
1903	Lost River/Bog Pond	398	982
1903	Chocorua (2)	734	1,813
1905	Pinkham Notch	160	396
1907	Owls Head	4,296	10,610
1908	Flume Mtn.	171	423
1911	Carter-Moriah Trail	337	833
1912-1914	Rocky Branch	1,968	4,862
1915	Chocorua (3)	> 576	> 1,422
1923	Flat Mountain	1,276	3,152
	Sum of other small fires	463	1,144
	Subtotal, 1800-1880	13,868	34,254
	Subtotal, 1903 alone	28,109	69,430
	Subtotal, 1886-1923	42,387	104,697
	Total, All Fires	56,255	138,951



Figure 1: The 1911 survey of the Wild River Valley, then owned by Hastings Lumber Company and F.H. Wheeler, displayed Susan Cone of the White Mountain National Forest Headquarters in Laconia, NH.

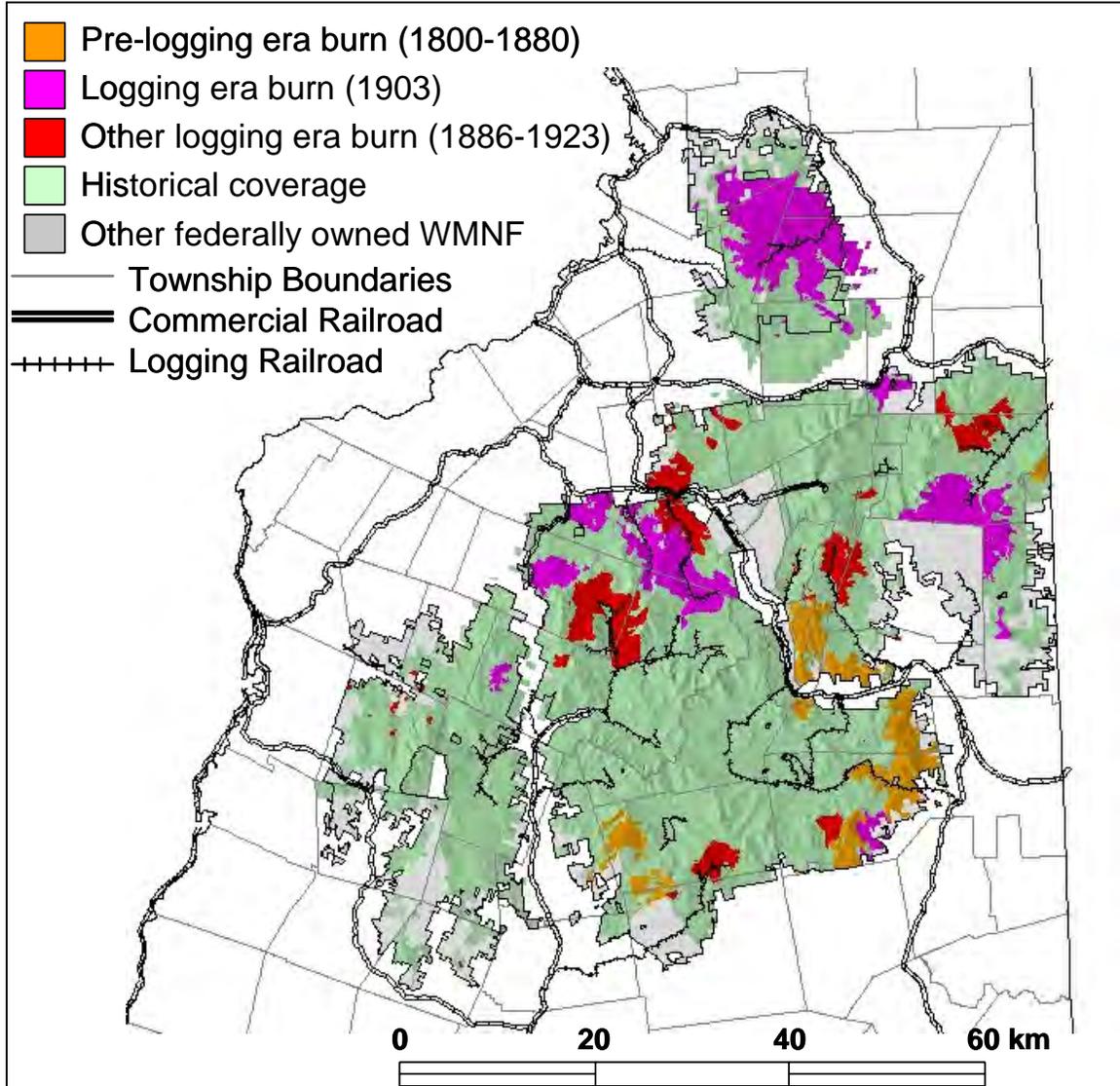


Figure 2: Map of 19<sup>th</sup> and early 20<sup>th</sup> century fires within the White Mountain National Forest, NH. Railroads, township, and national forest boundaries from N.H. GRANIT; logging railroads taken from Belcher (1980).

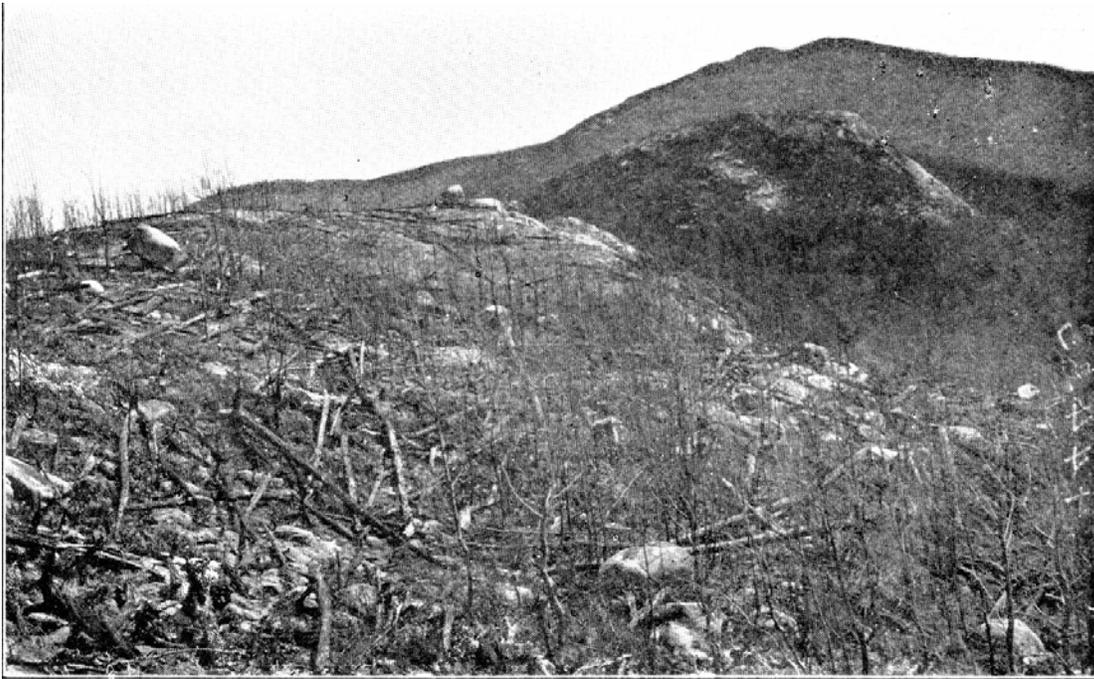


FIG. 1.—NORTH SUGAR LOAF, ONCE HEAVILY TIMBERED, NOW PRACTICALLY BARREN.

Figure 3: Summit of Mt. Sugarloaf with Mt. Hale at upper right, photographed in 1903 (From Chittenden, 1904, and courtesy of the Milne Special Collections and Archives Department, University of New Hampshire Library, Durham, NH).