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Forest Resources of the Clearwater National Forest

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About the author

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The Interior West Forest Inventory and Analysis (IWFIA) Program of the USDA Forest Service, Rocky Mountain Research Station, as part of our National Forest System cooperative inventories, conducted a forest resource inventory on the Clearwater National Forest using a nationally standardized mapped-plot design (for more details see section "Inventory methods"). This report presents the highlights of this 1999 inventory using commonly requested variables and summaries. The data could be summarized in other ways for different purposes (see "For further information" on the inside back cover). The information presented in this report is based solely on the IWFIA inventory sample (USDA 1999). Supplementary documentation and inventory terminology can be located in USDA 2002. Additional data collected by the Clearwater National Forest and used separately or in combination with IWFIA data may produce varying results. Changes since the inventory, such as the impact of recent disturbances on the forest, have not been incorporated into this report. Annual inventories will soon replace periodic inventories to help monitor these changes at shorter intervals.

Description of the Clearwater National Forest

The Clearwater National Forest administers 1,825,422 acres (USDA 1999) of which 95 percent is forest land, and 5 percent is nonforest or water (fig. 1). This report describes the characteristics of the forest land sampled on the Clearwater. Forest land is land that is at least 10 percent stocked (or formerly stocked) with live tally tree species and is greater than 1 acre in size and 120 feet wide. Based on tree species present, forest land is subdivided into timberland, where most trees are timber species commonly used for wood products (such as Douglas-fir and lodgepole pine), and woodland, where most trees often have a multi-stem growth form and are not typically used for industrial wood products (such as Rocky Mountain Maple). Thirteen percent of the total area on the Clearwater National Forest is reserved designation in the Selway-Bitterroot Wilderness area. This report focuses on forest resources of all the forest land administered by the Clearwater National Forest. A subsequent section will address nonreserved timberland.

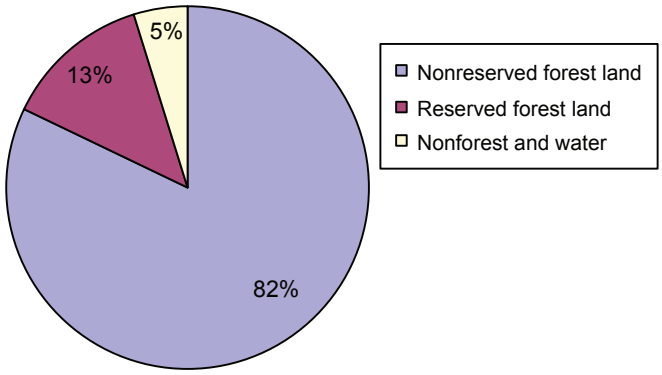

Figure 1—Percent area by land class and reserved status, Clearwater National Forest, 1999.

Forest land highlights of the Clearwater National Forest

Forest type—Forest resources are often described using a forest type classification. Forest type refers to the predominant tree species in a stand, based on plurality of tree stocking. Stocking is an expression of the extent to which growing space is effectively utilized by live trees.

Forest types are dynamic and can change slowly through forest succession, or rapidly due to disturbances such as logging, fire, or insect and disease epidemics. Figure 2 presents the distribution of forest land area on the Clearwater National Forest by forest type. The spruce-fir forest type is the most common at 26 percent, followed in abundance by Douglas-fir at 21 percent. The grand fir forest type comprises 19 percent of the forest land area; lodgepole pine, 13 percent; western redcedar, 8 percent; Engelmann spruce, 4 percent; mountain hemlock and maple woodland 3 percent; and paper birch, western larch and ponderosa pine, 1 percent.

Tree and stand size—The size distribution of trees is an indicator of structural diversity. Figure 3 displays the distribution of the 730 million live trees, 1 inch diameter at breast height or greater, on the Clearwater National Forest by diameter class. Overall, this shows a typical diameter distribution with a higher number of small trees than large trees. Trees often reproduce prolifically, but thin out naturally over time due to competition for resources.

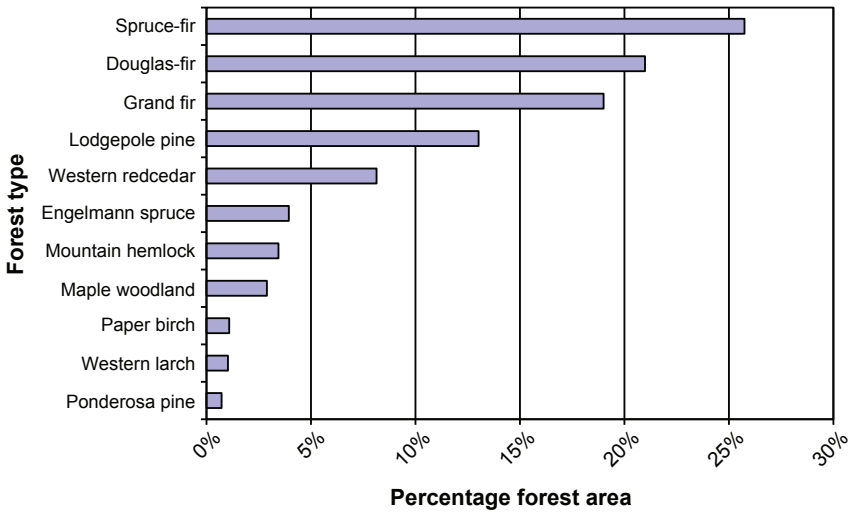

Figure 2—Percent of total forest land area by forest type, Clearwater National Forest, 1999.

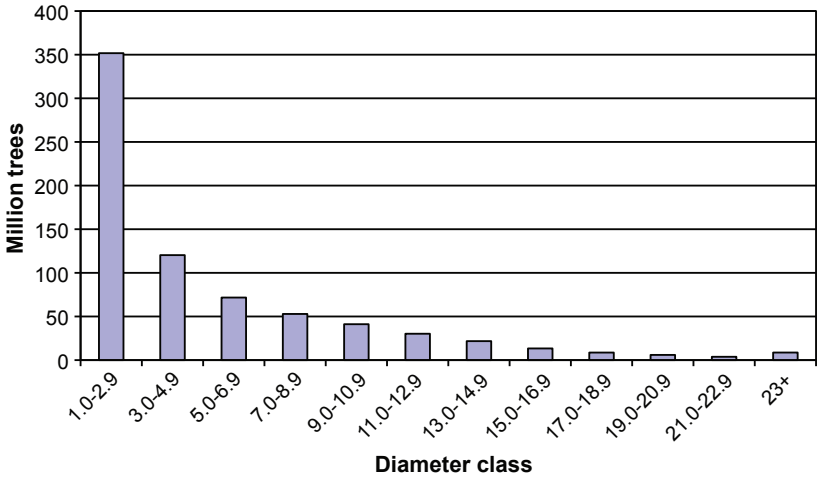

Figure 3—Number of live trees on forest land by 2-inch diameter class, Clearwater National Forest, 1999.

Stand-size class is a classification of forest land based on the dominant diameter-size of live trees that contribute to stand stocking. Large trees are timber-type softwoods and all woodland tree species 9.0 inches diameter and greater, and timber-type hardwoods 11.0 inches diameter and greater; medium trees include timber-type softwoods and all woodland tree species 5.0 to 8.9 inches diameter, and timber-type hardwoods 5.0 to 10.9 inches diameter; and saplings/seedlings comprise all trees under 5.0 inches diameter. Nonstocked stands are typically those that have been recently disturbed by tree cutting, forest fire, or other large-scale change. For tree stocking, fewer large-diameter trees compared to small-diameter trees are required to fully stock a site. Figure 4 shows a breakdown of forest land on the Clearwater National Forest by area and stand-size class. Seventy-one percent of the stands have a majority of stocking from large trees, while 4 percent are nonstocked.

Figure 5 shows the area of forest land by forest type and stand-size class on the Clearwater National Forest. The two most common forest types in the large (9 inches or greater) tree class are the spruce-fir and Douglas-fir forest types, which together make up 46 percent of the large tree stands. Forty-two percent of the stands in the medium (5-8.9 inches) tree class are the lodgepole pine forest type.

Number of live trees—Another way to assess forest diversity is by examining the composition of forest land by tree diameter and species. Figure 6 shows the 730 million live trees by species in three diameter-size classes. Sixty-five percent of all live trees on the Clearwater National Forest are from 1.0 to 4.9 inches diameter, 17 percent are from 5.0 to 8.9 inches diameter, and 18 percent are 9.0 inches diameter and greater. Grand fir makes up 22 percent of the total number of trees; subalpine fir, 19 percent; western redcedar, 14 percent; Douglas-fir,

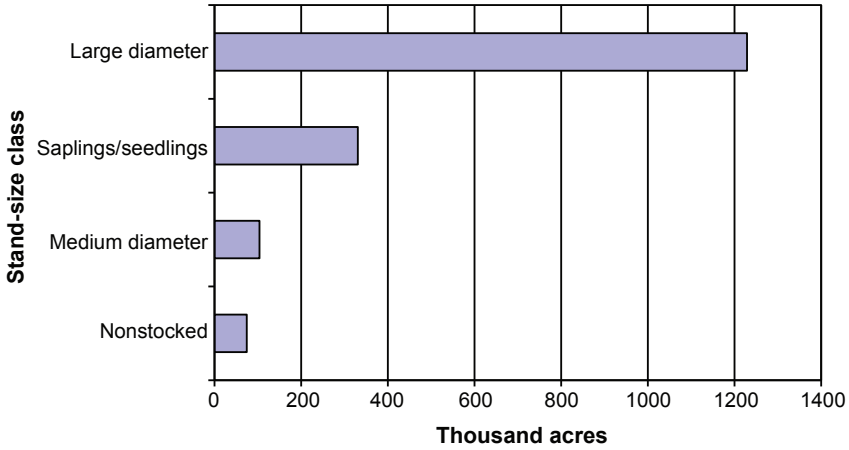

Figure 4—Area of forest land by stand-size class, Clearwater National Forest, 1999.

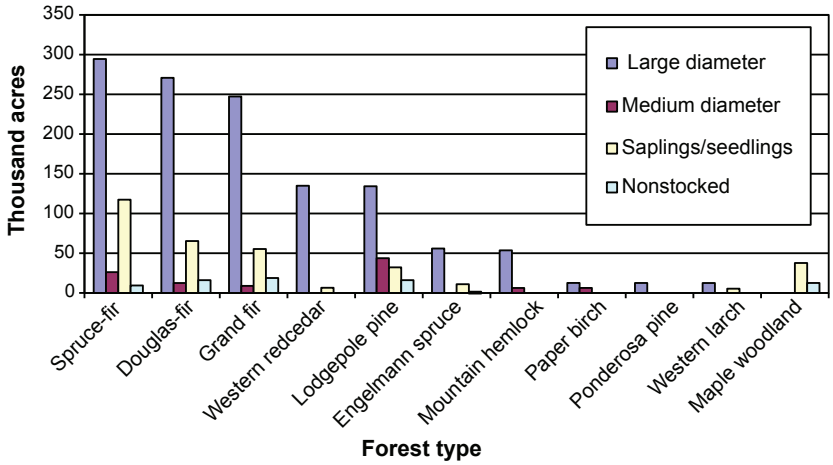

Figure 5—Area of forest land by forest type and stand-size class, Clearwater National Forest, 1999.

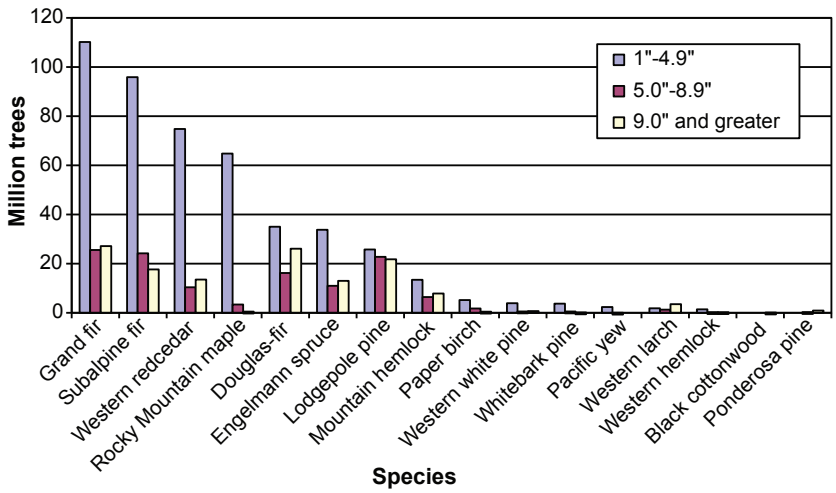

Figure 6—Number of live trees 1.0 inch diameter and greater on forest land by species and diameter class, Clearwater National Forest, 1999.

11 percent; lodgepole pine, 10 percent; Rocky Mountain maple, 9 percent; Engelmann spruce, 8 percent; mountain hemlock, 4 percent; paper birch, 1 percent; and the remaining species in figure 6 comprise the final 1 percent. Species that are scarce may not be encountered with the extensive sampling strategy used for this inventory.

Figure 7 shows the number of live trees by species and elevation class. Elevation is closely correlated with variations in local climate. Precipitation generally increases with rising elevation, while temperature decreases. Aspect complicates this general rule; allowing relatively warmer- and drier-site species to grow at higher elevations on south- and west-facing slopes. These factors have a profound effect on competition between tree species. The Clearwater National Forest displays some distinct elevation patterns in tree distribution: whitebark pine and subalpine fir do well at higher elevations (above 6,000 feet), while grand fir is a dominant species at both lower (below 4,000 feet) and mid elevations (4,000-6000 feet). Lodgepole pine is most common at the middle elevations.

Number and weight of dead trees—Standing and down dead trees are important for wildlife and in fire ecology, as well as acting as nutrient sinks and erosion controls. Approximately 44 million standing dead trees (snags) and 40 million down dead trees 5.0 inches diameter and greater are on forest land on the Clearwater National Forest. If trees 1.0 inch diameter and greater are included there are 115 million standing dead trees and 100 million down dead trees.

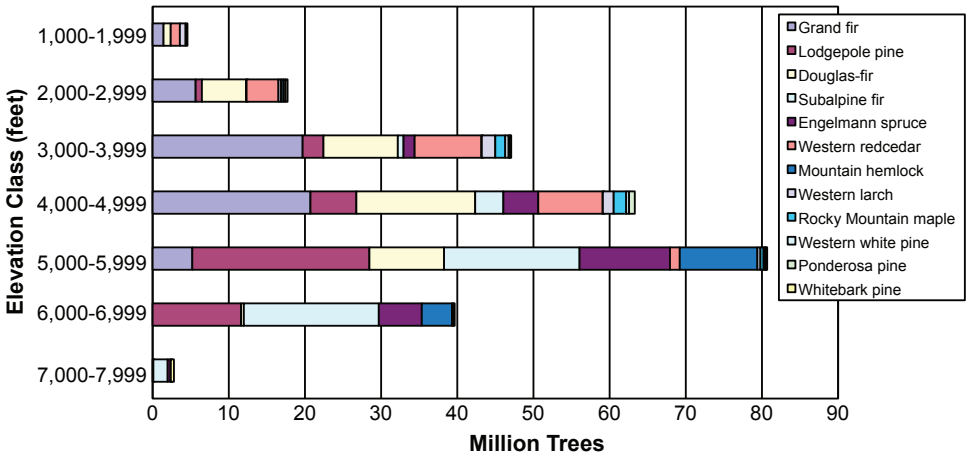

Figure 7—Number of live trees 5.0 inches diameter and greater on forest land by species and elevation class, Clearwater National Forest, 1999.

Many animals are dependent upon standing dead trees, but the species, size, and density of these trees required for quality habitat vary depending on wildlife species. Large diameter (11 inches or greater) dead trees are generally infrequent relative to smaller trees. Figure 8 shows the number of snags by forest type for three diameter classes. Of the total number of snags, 61 percent are between 1 inch and 4.9 inches diameter, with 40.5 snags per acre in this diameter range; and 26 percent are between 5 and 10.9 inches diameter, with 16.9 snags per acre. Snags 11 inches diameter and larger make up 13 percent of the total, with 8.5 snags per acre. Most of these large snags are found on spruce-fir (32 percent; 2.7 snags per acre), grand fir (22 percent; 1.9 snags per acre), and Douglas-fir (17 percent; 1.4 snags per acre) forest types.

The amount of dead material is a component of forest fuel loads. On the Clearwater, about 16.3 million tons of standing dead trees and 11.8 million tons of down dead trees are on forest land. This estimate includes the merchantable bole and bark of trees 5.0 inches diameter and greater. Figure 9 shows the weight per acre of down dead trees by stand-size class for each of the forest types and all forest types combined. For all forest types combined, the large tree stand-size class has the highest weight at 8.3 tons per acre, followed by the medium class at 4.2 tons per acre. For all stand-size classes combined, the mountain hemlock has the highest weight at 11.7 tons per acre, followed by western redcedar, and spruce-fir at 11.4 and 7.7 tons per acre, respectively. Some class breakdowns such as the western larch nonstocked class may not be representative due to small sample size.

Stand age—Stand age for this report is estimated from core samples of live trees. The estimate is limited to trees with diameters that fall in a stand's designated stand-size class. Many other factors affect the number of sample trees available for determining stand age. In general, stand age for dense stands that contain more core sample trees is more representative than stand age for sparse stands that contain less.

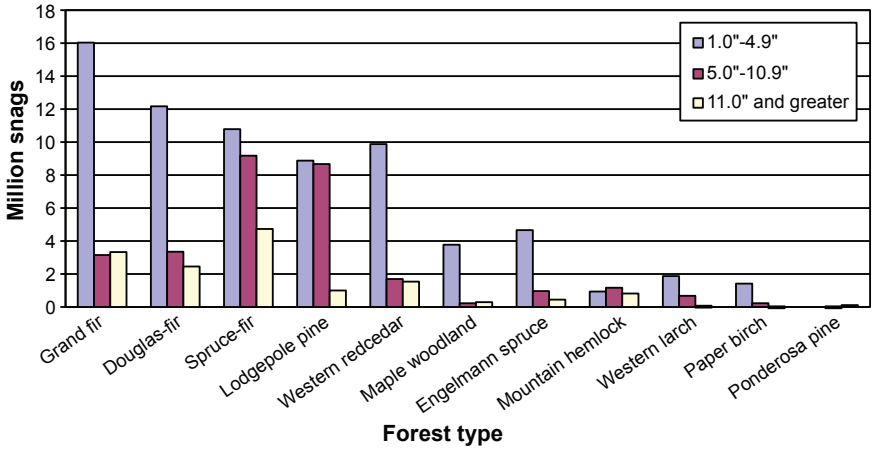

Figure 8—Number of standing dead trees 1.0 inch diameter and greater on forest land by forest type and diameter-size class, Clearwater National Forest, 1999.

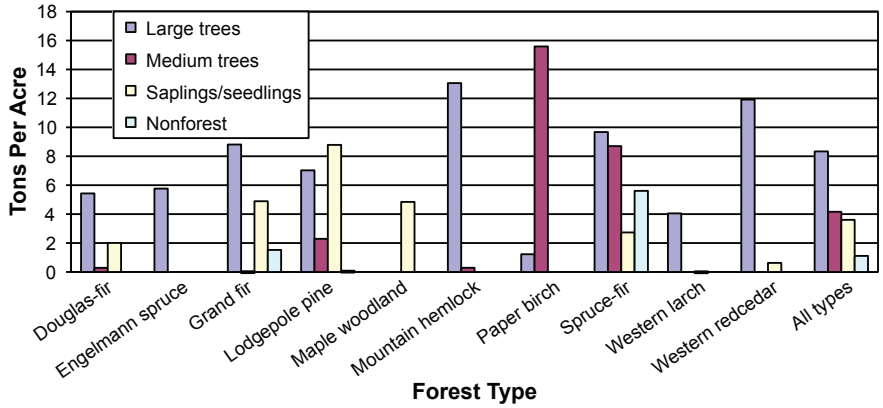

Figure 9—Weight of down dead trees 5.0 inches diameter and greater on forest land by forest type and stand-size class, Clearwater National Forest, 1999.

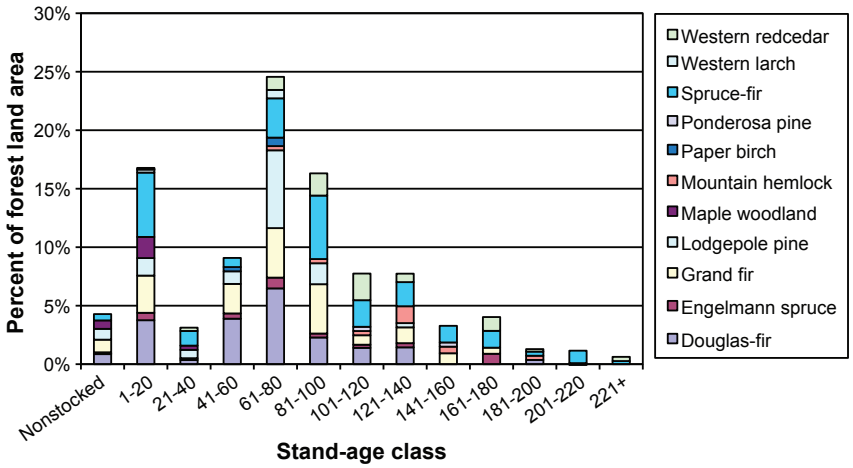

Figure 10—Percent of forest land area by forest type and stand-age class, Clearwater National Forest, 1999.

Figure 10 displays the percent of forest land area by forest type and stand-age class on the Clearwater National Forest. Stand age can indicate the duration since the last extensive disturbance of the forest overstory. This figure shows the 61- to 80-year class as the most common on the Forest, followed by the 1- to 20-year and 81- to 100-year age classes.

Wood volume, biomass, and basal area of live trees—Estimates of cubic-foot volume and basal area include all live trees 5.0 inches diameter and greater. Basal area is the cross-sectional area of a tree stem/bole (includes bark) at the point of diameter measurement. Biomass estimates include boles, bark, and branches of all live trees 1.0 inches diameter and greater. The net volume of wood on the Clearwater National Forest is estimated to be in excess of 5.9 billion cubic feet. Total biomass of wood is estimated at just over 99 million tons and the total basal area is estimated to be about 199 million square feet. Table 1 is a breakdown of volume, biomass, and basal area by species.

Figure 11 displays the percent net cubic-foot volume of live trees by diameter class. Eighty-nine percent of this volume is in the 9.0- to 10.9-inch and greater diameter class. By species, 100 percent of black cottonwood, 99 percent of ponderosa pine, 96 percent of mountain hemlock, 95 percent of western white pine, and 94 percent each of western redcedar and western larch volume is in trees 9.0 inches diameter and greater. Common species with lower percentages of volume in trees 9.0 inches diameter and larger include subalpine fir at 78 percent, paper birch at 52 percent, whitebark pine at 44 percent, and Rocky Mountain maple at 42 percent.

Another way to look at wood volume is by forest type, for which estimates per acre can be computed along with basal area (table 2). These numbers include the many different species that can occur together in each forest type. The highest basal area per acre on the Clearwater National Forest is in the western redcedar forest type, followed by mountain hemlock and ponderosa pine. Ponderosa pine is the highest volume per acre. Volume

Table 1—Net volume, biomass, and basal area on forest land by species, Clearwater National Forest, 1999.

Species	Volume (Million cubic feet)	Biomass (Million tons)	Basal area (Million square feet)
Grand fir	1,438.4	23.5	41.4
Douglas–fir	1,035.9	20.2	37.6
Western redcedar	825.3	12.8	31.0
Lodgepole pine	724.1	11.6	24.2
Engelmann spruce	632.6	9.4	19.4
Subalpine fir	541.5	9.0	22.3
Mountain hemlock	357.2	6.5	12.8
Western larch	125.4	2.4	4.1
Ponderosa pine	92.0	1.7	2.3
Western white pine	53.0	0.9	1.4
Rocky Mountain maple	15.4	0.7	1.1
Paper birch	14.5	0.3	0.7
Western hemlock	7.9	0.2	0.3
Whitebark pine	4.9	0.1	0.3
Black cottonwood	2.2	†	0.1
Pacific yew	†	†	†
Total (not exact due to rounding)	**5,870.5**	**99.2**	**199.0**

† – Less than 100,000

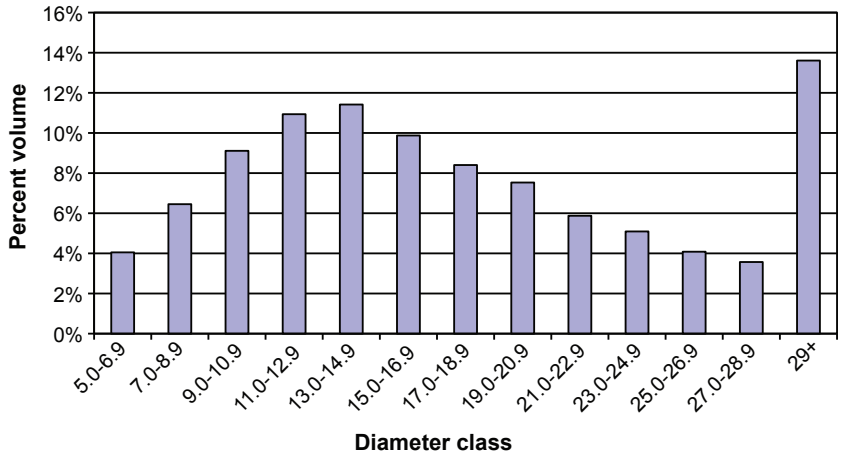

Figure 11—Percent of total net cubic-foot volume of live trees by diameter class, Clearwater National Forest, 1999.

Table 2—Net volume per acre, biomass per acre, basal area per acre, number of conditions, and condition proportions on forest land by forest type, Clearwater National Forest, 1999.

Forest type	Volume (cubic ft. per acre)	Biomass (tons per acre)	Basal area (sq. ft. per acre)	Number of conditions[a]	Condition proportion[b]
Western redcedar	6,252	9.3	214	29	24.0
Mountain hemlock	6,011	107.5	211	10	10.0
Ponderosa pine	6,854	124.9	171	2	2.0
Grand fir	3,920	65.7	118	63	55.3
Western larch	3,680	66.7	128	4	3.4
Engelmann spruce	3,472	53.3	113	14	11.4
Douglas-fir	3,311	60.9	116	67	61.5
Lodgepole pine	2,688	44.2	94	38	36.9
Spruce-fir	2,420	39.2	88	80	73.8
Paper birch	1,744	34.6	75	3	3.0
Maple woodland	231	5.3	12	10	8.3
Total	**3,378**	**57.1**	**115**	**320**	**289.7**

[a] Number of conditions by forest type that were sampled. These numbers are often greater than the total number of forested plots by forest type because a plot may sample more than one forest condition.
[b] Sum of the condition proportions of plots by forest type that were sampled. These numbers are often less than the total number of plots by forest type because of nonforest condition proportions (from plots containing both forest and nonforest conditions) that are not included here.

and basal area per acre for maple may not be representative due to the small sample size. One characteristic of the mapped-plot design is that a plot may sample more than one condition (last two columns of table 2). A forest condition is generally defined as an area of relatively homogeneous vegetative cover that meets the criteria for forest land. Forest type is one of several attributes that define and separate conditions identified on the plot.

Stand density index—Many factors influence the rate at which trees grow and thrive, or die. As tree size and density increase, competition for available resources also increases. Stand density index (SDI), as developed by Reineke (1933), is a relative measure of quantifying the relationship between trees per acre and average stand diameter. The concept was developed for even-aged stands dominated by one or two related size classes (based on diameter and/or height), but can also be applied to uneven-aged stands composed of three or more size classes (Long and Daniel 1990; Shaw 2000). SDI is usually presented as a percentage of the maximum SDI for each forest type (Van Dyck 2002). Maximum SDI values for the forest types on the Clearwater National Forest were estimated using FIA plot data, and formulated specifically to match the procedure used by FIA to calculate

SDI (Shaw 2000). Resulting percentages were grouped into four classes (fig. 12), whose thresholds have ecological and management significance. A site is considered to be fully occupied at 35 percent of SDI maximum, which marks the onset of competition-related stresses and slowed growth rates (Long 1985). Based on FIA sample data, 58 percent of all forest stands on the Clearwater National Forest are considered to be fully occupied.

Components of change: growth—Another measure of forest vigor is net annual growth. Net annual growth is the difference between gross annual growth and losses due to mortality. Gross annual growth of live trees (5.0 inches diameter and greater) on all forest land on the Clearwater National Forest is estimated to be 154 million cubic feet, and net annual growth is 116 million cubic feet. Gross annual growth is compared to mortality for seven high volume species in figure 13. Mortality on all forest land on the Clearwater National Forest is about 25 percent of gross annual growth. Mortality is only about 2.6 percent of gross annual growth for western larch, 3.3 percent for Rocky Mountain maple, 8.8 percent for whitebark pine, and 11.5 for western redcedar, while mortality exceeds growth by 126 percent for western white pine. The leading cause of mortality for all species was disease (49 percent of mortality) and insects (20 percent of mortality).

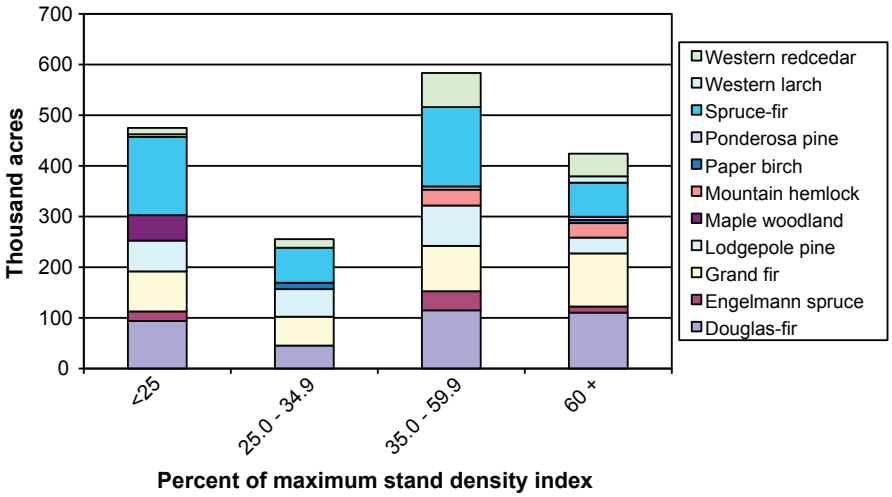

Figure 12—Area of forest land by forest type and percent stand density index, Clearwater National Forest, 1999.

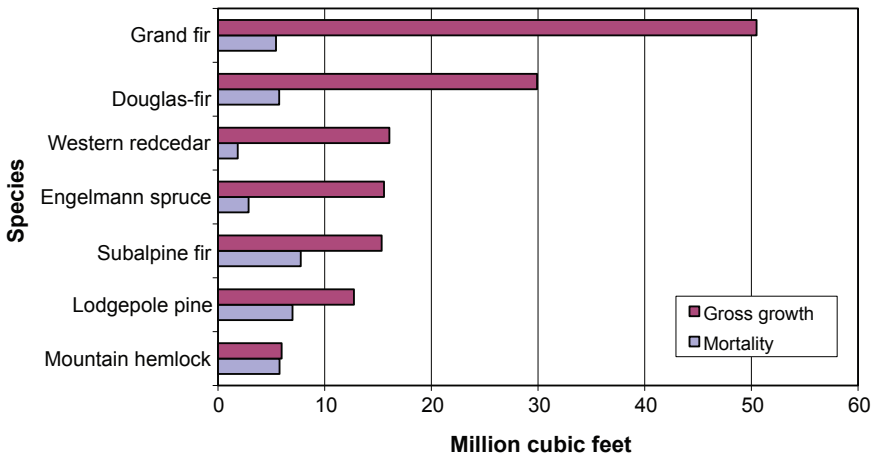

Figure 13—Gross annual growth of all live trees 5.0 inches diameter and greater compared to mortality for seven high-volume species on all forest land, Clearwater National Forest, 1998.

Components of change: mortality—Field crews assess which trees have died in the past 5 years; these trees are used to estimate an average annual mortality. Based on this estimate, in 1999, 38.1 million cubic feet of wood from live trees (5.0 inches diameter and greater) died on the Clearwater National Forest. About 49 percent of the mortality was caused by disease, 22 percent by weather, 20 percent by insects, 5 percent unknown, and 3 percent was fire–related. The following are the top five mortality species accounting for 83 percent of overall mortality: subalpine fir (20 percent), lodgepole pine (18 percent), Douglas-fir and mountain hemlock (15 percent), and grand fir (14 percent).

Understory vegetation—Understory vegetation provides forage and cover for wildlife, contributes to forest fuel load, and can be an indication of the successional stage of the forest community. On each plot, field crews visually estimated crown canopy coverage for four plant groups—tree seedlings/saplings, shrubs, forbs, and graminoids (See USDA 1999 for details). Figure 14 shows the average percent cover of plant groups on forest land by forest type. Forest wide, Rocky Mountain maple is the most abundant understory seedling/sapling species, followed by grand fir. The most abundant understory shrubs are mountain huckleberry, fools huckleberry, and snowberry. Twinflower and queencup bead-lily are the most abundant forbs; and pinegrass, elk sedge, blue-grass, and timothy are the most abundant understory graminoids on the forest.

Nonreserved timberland highlights of the Clearwater National Forest

Reserved lands are those that have been withdrawn from management for production of wood products, such as wilderness areas and national parks. The nonreserved portion of the Clearwater contains nearly 86 percent of the forest land on the National Forest. There are 542 million live, growing-stock trees on nonreserved timberland, 72 million in reserved areas.

Forest type—Grand fir is the most common forest type on nonreserved timberland on the Clearwater at 24 percent, followed by spruce-fir (22 percent) and Douglas-fir (19 percent). On the reserved portion, Spruce-fir is the most common at 61 percent, followed by Engelmann spruce (16 percent) and lodgepole pine (13 percent).

Dead trees and fuels—There are approximately 35 million standing dead trees (snags) and 31 million down dead trees 5.0 inches diameter and greater on nonreserved timberland. Snags at least 11.0 inches diameter are found at densities of 8.2 per acre. There are 2.9 snags per acre 19.0 inches diameter or greater. The merchantable bole and bark of all dead trees at least 5.0 inches in diameter on reserved timberland is equal to about 1.6 million tons in standing dead and 2.0 million tons in down dead. With the exception of the medium tree (poletimber) class at 4.2 tons per acre on nonreserved timberland versus 0.0 on reserved land, weights per acre of down dead trees

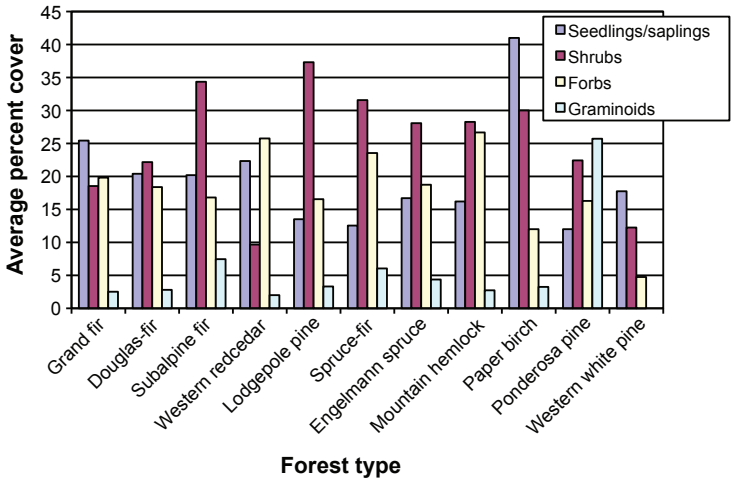

Figure 14—Average percent cover of trees (seedlings/saplings), shrubs, forbs, and graminoids on forest land by forest type, Clearwater National Forest, 1999.

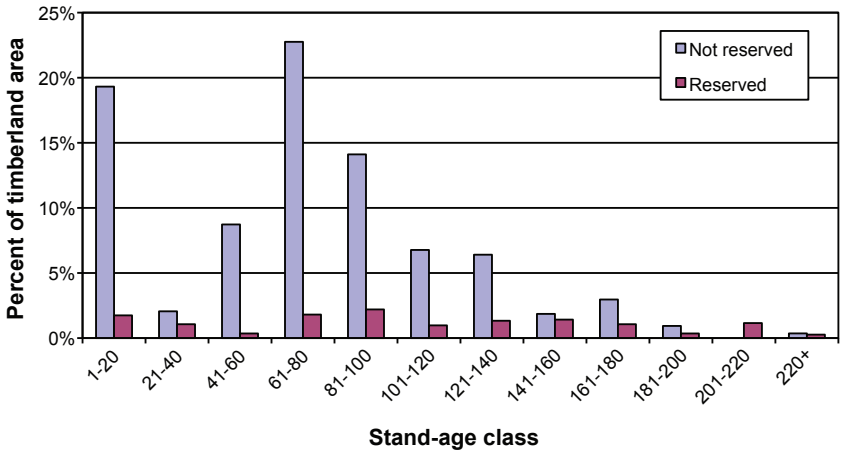

Figure 15—Percent of timberland by reserved designation and stand-age class, Clearwater National Forest, 1999.

on nonreserved timberland are similar for those on all forest land, both by stand-size class for all forest types combined (large tree class at 8.2 tons per acre and seedling/sapling class at 3.6 tons per acre) and by forest type for all size classes combined (mountain hemlock type at 11.7 tons per acre, western redcedar at 11.4 tons per acre, and grand fir at 7.5 tons per acre).

Stand age—Stands are generally younger on nonreserved timberland than on all forest land, with the 61- to 80-year age class being the most common, followed by the 81- to 100- year age class (fig. 15). The 61- to 80-year age class is also the most common in the reserved area. Fifty-five percent of all trees in reserved areas are 101 years and greater in age, compared to 24 percent in nonreserved areas.

Wood volume, biomass, and basal area of growing-stock trees—Table 3 displays a breakdown of net cubic volume, tons of wood biomass,and square foot basal area for growing-stock trees 5 inches diameter and greater by species on nonreserved timberland for the Clearwater. The total net cubic-foot volume is nearly 5.1 billion cubic feet. Grand fir and Douglas-fir together account for 46 percent of the volume on nonreserved timberland. Total wood biomass is estimated at 82 million tons. Forty-four percent of the biomass on nonreserved timberland consists of grand fir and Douglas-fir. Total basal area is estimated at 169 million square feet. Grand fir and Douglas-fir comprise 44 percent of basal area on nonreserved timberland.

The net volume of sawtimber trees (sawtimber volume) on nonreserved timberland is estimated to be over 26.1 billion board feet (International ¼-inch rule). This includes all growing-stock trees 9.0 inches diameter and greater for softwoods, and 11.0 inches diameter and greater for hardwoods. Figure 16 illustrates the sawtimber volume on timberland by diameter class. The 29-inch and greater-inch diameter class has the most volume at 15 percent, followed closely by the 13.0 to 14.9-inch class at 12 percent. Twenty-six percent of the total sawtimber volume on the Clearwater National Forest is from grand fir, with 22 percent from Douglas-fir, 17 percent from western redcedar, and 13 percent from spruce-fir forest type.

Stand density index—Sixty percent of nonreserved timberland stands on the Clearwater National Forest are at 35 percent or more of SDI maximum, or considered

Table 3—Net volume, biomass, and basal area of growing-stock trees 5 inches diameter and greater by species on nonreserved timberland, Clearwater National Forest, 1999.

Species	Volume (Million cubic feet)	Biomass (Million tons)	Basal area (Million square feet)
Grand fir	1,380.8	21.8	39.4
Douglas–fir	955.1	18.2	34.2
Western redcedar	754.3	10.6	27.4
Lodgepole pine	617.3	9.6	20.6
Subalpine fir	356.6	5.3	14.4
Mountain hemlock	355.5	6.3	12.7
Engelmann spruce	350.8	5.1	11.4
Western larch	113.5	2.2	3.8
Ponderosa pine	91.4	1.6	2.3
Western white pine	53.0	0.9	1.4
Paper birch	13.3	0.2	0.6
Western hemlock	7.9	0.1	0.3
Black cottonwood	2.2	†	0.1
Whitebark pine	2.1	†	0.1
Pacific yew	†	†	†
Total (not exact due to rounding)	**5053.8**	**81.8**	**168.7**

† – Less than 100,000

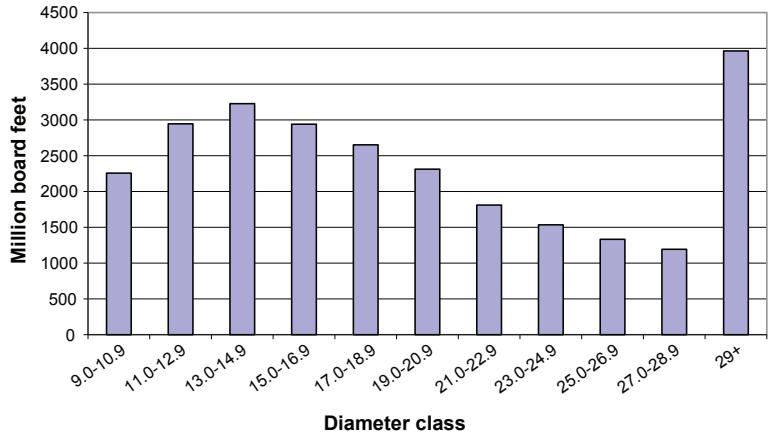

Figure 16—Net volume of sawtimber trees (International 1/4" rule) on nonreserved timberland by 2-inch diameter class on Clearwater National Forest, 1999.

to be fully occupied. Forty-four percent of Engelmann spruce stands, 53 percent of lodgepole pine stands, 61 percent of Douglas-fir stands, and 79 percent of western redcedar stands are fully occupied.

Components of change: growth and mortality—Gross annual growth of growing-stock trees on nonreserved timberland on the Clearwater is estimated at 135.8 million cubic feet, while mortality is an estimated 29.5 million cubic feet. Gross annual growth is compared to mortality of growing-stock trees for seven high volume species in figure 17. Mortality is 22 percent of growth on nonreserved timberland. Mortality volume was highest in mountain hemlock and lodgepole pine.

Inventory methods

Forest Inventory and Analysis (FIA) provides a statistically based sample of forest resources across all ownerships that can be used for planning and analyses at local, state, regional, and national levels. IWFIA uses a two-phase sampling procedure for all inventories. Phase one is based on a grid of sample points systematically located every 1,000 meters across all lands in a state. Phase one points are assigned ownership and vegetative cover attributes using maps and remotely sensed imagery. Field crews conduct phase two of the inventory on the subsample of phase one points that occur on forest land. The sampling intensity is one field plot every 5,000 meters, or about every 3 miles. Phase two plots are stratified based on phase one ownership and vegetation information, and weights are assigned to each stratum based on the proportion of phase one points in that stratum.

Phase two plots were sampled using the mapped-plot design (see next section). There were 304 field plots on the Clearwater National Forest, no plots were completely hazardous or inaccessible. However, 11 plots contained portions that were inaccessible. A total of 272 field plots sampled only forest conditions, 23 sampled both forest and nonforest conditions, 3 sampled both forest and water conditions (rivers, reservoirs, lakes, etc. at least 30 feet wide or 1 acre in area), 6 sampled only nonforest conditions, and none sampled only water. A total of 320 forest conditions were sampled on 298 plots that contain 289.7 forest, 7.6 nonforest, and 0.7 water condition proportions.

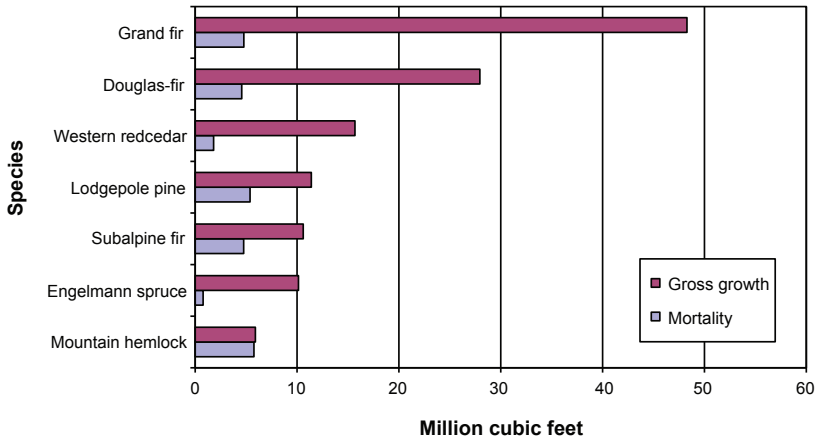

Figure 17—Gross annual growth of growing-stock trees 5.0 inches diameter and greater compared to mortality for seven high volume species on non reserved timberland, Clearwater National Forest, 1998.

About the mapped-plot design—The mapped-plot design was adopted by FIA nationwide by 1995. Its predetermined subplot layout uses boundary delineation, when necessary, to classify differing conditions. Most plots sample one forest condition; therefore, delineating conditions is often not required.

Conditions were separated, or mapped, based on differences in any of five attributes: forest/nonforest, forest type, stand-size class, stand origin, and stand density. The condition proportion is the fraction of plot area sampled in each condition. The sum of all condition proportions for any given plot equals 1.00. Therefore, the number and relative size of plot conditions determines the weighted area used for sample expansion.

Standard errors—The sample was designed to meet national standards for precision in state and regional estimates of forest attributes. Standard errors, which denote the precision of an estimate, are usually higher for smaller subsets of the data. Forest-level estimates and percent standard errors by land class or type of trees for various attributes are presented in table 4. Standard errors for other estimates are available upon request (see "For further information" section on the inside back cover).

Table 4—Percent standard error for area estimates on total forest land and reserved timberland; and percent standard errors for estimates of net volume, net annual growth, and annual mortality for live trees on total forest land and growing-stock trees (5.0 inches d.b.h. and greater) on nonreserved timberland, Clearwater National Forest, 1999.

Land class or type of trees	Attribute	Area or volume	Percent standard error
Total forest land (acres)	Area	1,737,816	±1.1
Total forest land (all trees cubic feet)	Volume	5,870,533,579	±4.9
	Growth	115,679,252	±8.4
	Mortality	38,139,120	±18.7
Nonreserved timberland (acres)	Area	1,448,793	±1.6
Nonreserved timberland (growing-stock trees cubic feet)	Volume	5,065,033,126	±5.4
	Growth	106,327,470	±8.8
	Mortality	29,493,241	±22.4

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For further information

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Selected data for this National Forest are part of a national data base that houses information for much of the forest land in the United States. This data base can be accessed on the Internet at the following web site:

http://ncrs2.fs.fed.us/4801/fiadb/fim17/wcfim17.asp

The Rocky Mountain Research Station develops scientific information and technology to improve management, protection, and use of the forests and rangelands. Research is designed to meet the needs of National Forest managers, Federal and State agencies, public and private organizations, academic institutions, industry, and individuals.

Studies accelerate solutions to problems involving ecosystems, range, forests, water, recreation, fire, resource inventory, land reclamation, community sustainability, forest engineering technology, multiple use economics, wildlife and fish habitat, and forest insects and diseases. Studies are conducted cooperatively, and applications may be found worldwide.